

EXHIBIT A

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE**

CORDIS CORPORATION,

Plaintiff,

V.

Case No. 97-550-SLR
(Consolidated)

MEDTRONIC VASCULAR, INC.
BOSTON SCIENTIFIC CORPORATION,
and SCIMED LIFE SYSTEMS, INC.,

Defendants.

**BOSTON SCIENTIFIC CORPORATION,
and SCIMED LIFE SYSTEMS, INC.**

Plaintiffs,

V.

Case No. 98-19-SLR

ETHICON, INC.,
CORDIS CORPORATION, and
JOHNSON & JOHNSON
INTERVENTIONAL SYSTEMS CO.

Defendants.

JUDGMENT IN A CIVIL CASE

Pursuant to the Notice of Withdrawal of Claims Based on U.S. Patent No. 5,102,417, dated March 22, 2000 (D.I. 662); the jury verdict, dated December 11, 2000 (D.I. 182 (in C.A. 98-197-SLR)); the Court's Memorandum Opinion and Order, dated March 28, 2002 (D.I. 1127; D.I. 1128); the Court's Memorandum Order, dated May 15, 2002 (D.I. 1153); the Court's ruling (D.I. 1253, 9/22/04 Tr. 27); and the jury verdict, dated March 24, 2005 (D.I. 1366):

IT IS ORDERED AND ADJUDGED that judgment be and is hereby entered in favor of Cordis Corporation, Ethicon Inc. and Johnson & Johnson Interventional Systems Co. (collectively "Cordis") and against Boston Scientific Corporation and Boston Scientific Scimed, Inc. (formerly Scimed Life Systems, Inc.) (collectively "BSC") with respect to the infringement of claims 23 and 44 of United States Patent No. 4,739,762 (the "'762 patent");

IT IS FURTHER ORDERED AND ADJUDGED that judgment be and is hereby entered in favor of BSC and against Cordis with respect to the infringement of claim 22 of United States Patent No. 5,902,332 (the "'332 patent");

IT IS FURTHER ORDERED AND ADJUDGED that judgment be and is hereby entered in favor of Cordis and against BSC with respect to the validity of claim 23 of the '762 patent for obviousness;

IT IS FURTHER ORDERED AND ADJUDGED that judgment be and is hereby entered in favor of BSC and against Cordis with respect to the validity of claim 44 of the '762 patent and claim 22 of the '332 patent;

IT IS FURTHER ORDERED AND ADJUDGED that judgment be and is hereby entered in favor of Cordis and against BSC with respect to the enforceability of the '762 patent and the '332 patent;

IT IS FURTHER ORDERED AND ADJUDGED that judgment be and is hereby entered in favor of BSC and against Cordis with respect to the infringement of claims 51, 52 and 54 of the '762 patent, claims 17, 18, 25 and 26 of U.S. Patent No. 5,102,417, and claim 24 of the '332 patent;

IT IS FURTHER ORDERED AND ADJUDGED that, pursuant to the Court's ruling (D.I. 1253, Sept. 22, 2004 Tr. 27), the issue of damages for BSC's infringement of claim 23 of the '762 patent is deferred until after all the relevant liability issues are finally determined through appeal;

IT IS FURTHER ORDERED AND ADJUDGED that BSC, its officers, agents, servants, employees, and attorneys, and those persons in active concert or participation with them who receive actual notice of the order by personal service or otherwise, are hereby enjoined, until November 7, 2005, the expiration date of the '762 patent, from infringing claim 23 of the '762 patent by making, using, selling or offering for sale in the United States, or by importing into the United States, the NIR stent;

IT IS FURTHER ORDERED AND ADJUDGED that, pursuant to Fed. R. Civ. P. 62(c), this injunction is hereby stayed during the pendency of any appeals of the judgment in this case;

IT IS FURTHER ORDERED AND ADJUDGED that, pursuant to Fed. R. Civ. P. 54(d)(1) and D. Del. LR 54.1, each party will bear its own costs.

Dated: _____, 2005

United States District Judge

(By) Deputy Clerk

EXHIBIT B

LEXSEE 2004 US DIST LEXIS 10730

UNION CARBIDE CHEMS. & PLASTICS TECH. CORP. and UNION CARBIDE CORP., Plaintiffs, Counter-Defendants, v. SHELL OIL CO., SHELL CHEMICAL CO., and CRI CATALYST CO., Defendants, Counter-Plaintiffs. SHELL OIL CO., Plaintiff, v. UNION CARBIDE CHEMS. & PLASTICS TECH. CORP. and UNION CARBIDE CORP., Defendants.

Civ. No. 99-CV-274-SLR (Consolidated), Civ. No. 99-846-SLR

UNITED STATES DISTRICT COURT FOR THE DISTRICT OF DELAWARE

2004 U.S. Dist. LEXIS 10730

June 9, 2004, Decided

PRIOR HISTORY: *Union Carbide Chems. & Plastics Tech. Corp. v. Shell Oil Co.*, 270 F. Supp. 2d 519, 2003 U.S. Dist. LEXIS 12694 (D. Del., 2003)

DISPOSITION: Defendants' motion to exclude certain testimony of Dr. Parvez H. Wadia was denied. Defendants' motion for judgment as a matter of law on plaintiff's claim of willfulness was denied as moot per the jury's verdict. Defendants' motions for judgment as a matter of law or, in the alternative, for a new trial were denied. Plaintiffs' motion for judgment as a matter of law was denied. Plaintiff's motion for prejudgment interest was granted. Plaintiffs' motion for a permanent injunction was granted. Defendants' motion for a stay of the permanent injunction was granted.

LexisNexis(R) Headnotes

COUNSEL: [*1] For UNION CARBIDE CHEMICALS & PLASTICS TECHNOLOGY CORPORATION, UNION CARBIDE CORPORATION, plaintiffs (99-CV-274): Jeffrey B. Bove, Connolly, Bove, Lodge & Hutz, Wilmington, DE.

For SHELL OIL COMPANY, SHELL CHEMICAL COMPANY, CRI CATALYST COMPANY, defendants (99-CV-274): Allen M. Terrell, Jr., Richards, Layton & Finger, Wilmington, DE.

For SHELL OIL COMPANY, plaintiff (99-CV-846): Jeffrey L. Moyer, Richards, Layton & Finger, Wilmington, DE.

For UNION CARBIDE CORPORATION, defendant (99-CV-846): Jeffrey B. Bove, Connolly, Bove, Lodge & Hutz, Wilmington, DE.

JUDGES: Sue L. Robinson, United States District Judge.

OPINIONBY: Sue L. Robinson

OPINION:

MEMORANDUM OPINION

Dated: June 9, 2004
Wilmington, Delaware

ROBINSON, Chief Judge

I. INTRODUCTION

On May 3, 1999 plaintiffs Union Carbide Chemicals & Plastics Technology Corporation ("UCC/PTC") and Union Carbide Corporation ("UCC" and collectively "Union Carbide") n1 filed this action against defendants Shell Oil Company, Shell Chemical Company, and CRI Catalyst Company (collectively "Shell"), alleging infringement of three United States patents owned by plaintiff. n2 In early 2001, the case was tried by a jury [*2] who found in favor of defendants on the issues of infringement and invalidity. Following the verdict, the court considered numerous motions by the parties for judgment as a matter of law. *Union Carbide Chems. & Plastics Tech. Corp. v. Shell Oil Co.*, 163 F. Supp. 2d

2004 U.S. Dist. LEXIS 10730, *

426 (D. Del. 2001). The case was subsequently appealed and, in November 2002, the United States Court of Appeals for the Federal Circuit affirmed in part and reversed in part the judgment and remanded the case for further proceedings. *Union Carbide Chemicals & Plastics Tech. Corp. v. Shell Oil Co.*, 308 F.3d 1167 (Fed. Cir. 2002).

n1 The court notes that all parties in their briefs, evidence, and arguments have largely treated the two plaintiffs and the two defendants as single entities. Consequently, except in the court's discussion of damages where the separate corporate existence is relevant, the court will similarly not distinguish.

n2 U.S. Patent No. 4,908,343 ("the '343 patent"); U.S. Patent No. 4,916,243 ("the '243 patent"); and U.S. Patent No. 5,057,481 ("the '481 patent").

[*3]

Between October 27 and November 3, 2003, a jury trial was held on the remanded issues. Submitted to the jury were Union Carbide's claims that Shell infringed claim 4 of the '243 patent and Shell's affirmative defenses of invalidity. The jury returned a verdict finding that Shell directly infringed claim 4 when it used its S-880 and S-882 catalysts in the production of ethylene oxide ("EO"). The jury also found that Shell's subsidiary, CRI, contributorily infringed claim 4 by selling to third parties Shell's S-863, S-880 and S-882 catalysts. The jury found that claim 4 was not invalid due to non-enablement, anticipation by prior art, or obviousness in light of the prior art. Finally, the jury awarded damages in the amount of \$ 112,198,893. Presently before the court are the parties' twenty-four post-trial motions, as well as the court's findings of fact and conclusions of law with respect to Shell's equitable defenses of laches and estoppel.

II. BACKGROUND

A. The Patent-in-Suit and Asserted Claim

The '243 patent is the only patent remaining in the present case. The '243 patent was a continuation of prior U.S. application Ser. No. 763,273 filed August 7, 1985, which [*4] was a continuation of application Ser. No. 497,231 filed May 23, 1983, now abandoned, which was a continuation of application Ser. No. 116,292 filed February 13, 1980, now abandoned, which was a continuation-in-part of Ser. No. 021,727 filed March 20, 1979, now abandoned. As described in the specification, the '243 patent comprises a process for the commercial

production of EO with a supported silver catalyst containing

a combination of (a) cesium and (b) at least one other alkali metal selected from the group consisting of lithium, sodium, potassium and rubidium, wherein (a) and (b) are present in amounts in relation to the amount of silver therein sufficient to increase the efficiency of the ethylene oxide manufacture to a value greater than the efficiencies obtainable under common operating conditions from respective catalysts which are the same as said catalyst except that instead of containing both (a) and (b), one contains the respective amount of (a), and the other contains the respective amount of (b).

('243 patent, col. 1, ll. 19-28) In short, this patent is directed to improved silver catalysts for the production of EO. EO is a chemical intermediate product, [*5] meaning it is a compound primarily used in the production of other chemical products. (D.I. 624 at 199-200) In the case of EO, it is a gas used in the production of ethylene glycol which is subsequently used in the production of synthetic substances such as polyester fiber, resin and film, and it is created when ethylene reacts with oxygen. n3 (Id. at 200-204)

n3 While ethylene glycol has more than one form, it is most commonly and profitably used in monoethylene glycol ("MEG"). Approximately 7.2 billion pounds of EO are produced each year, most of which is converted into MEG. Union Carbide and its parent corporation, Dow Chemical, produces approximately 1.4 billion pounds or twenty-five percent of the annual MEG domestic market. The average price of MEG is approximately \$ 0.25 per pound although that price is not stable. MEG sales are a growth market with about six percent annual domestic growth. (D.I. 624 at 204-08) As MEG is a fungible commodity, there is incentive for MEG manufacturers to reduce their cost structures. (D.I. 626 at 606-09)

[*6]

EO is produced through a highly exothermic reaction between ethylene and oxygen. n4 This process also results in the production of water and carbon dioxide. It is known in the art, however, that if certain

catalysts, such as the one claimed in the patent, are present during this process, a lower reaction temperature may be employed. n5 A lower reaction temperature reduces the amount of oxygen and water byproducts and results in greater production efficiency. Production efficiency, sometimes referred to as "selectivity", is defined by the percentage of ethylene that is converted to EO. (D.I. 624 at 245)

n4 In the case of the EO production process described in the '243 patent, the temperature range is from 200 to 300 degrees celsius. ('243 patent, col. 29, ln. 56)

n5 A catalyst is a chemical that increases the rate of a chemical reaction without being consumed or altered. (D.I. 625 at 241-42, 381)

It was understood in the prior art that one such catalyst that enhances reaction efficiency is silver. Prior [*7] to 1971, EO reaction efficiencies using silver as a catalyst had an efficiency of no greater than 65 percent. In 1971, a Shell scientist determined that small amounts of alkali metals had a promotional effect on silver-catalyzed EO reactions. These alkali metals when present in catalyzed EO reactions are referred to as "promoters." n6 ('243 patent, col. 3, ll. 43-61) In particular, it was learned that cesium when properly optimized could achieve an efficiency in the range of seventy-eight to eighty-two percent. (D.I. 625 at 304-06)

n6 These promoters are not themselves catalysts but act both to increase the efficiency of the reaction and to prolong the life span of the catalyst itself. It is also understood in the art that certain materials function as "inhibitors" in the EO reaction process by serving to reduce the amount of carbon dioxide produced. (D.I. 624 at 245-46; '243 patent, col. 3, ln. 30 - col. 4, ln. 47)

The '243 patent claims a process in which silver, cesium and at least one other alkali metal are [*8] combined to produce a synergistic effect, this synergistic effect being that the catalytic reaction efficiency is greater with the three materials present than with only silver and either cesium or one other alkali metal. ('243, col. 8, ll. 11-30; D.I. 625 at 270)

Claim 4, which is dependent on claim 1, is the only claim at issue in the case before the court and concerns a catalytic process in which silver, cesium and lithium are present. It claims:

1. In the continuous process for the production of ethylene oxide by the vapor phase oxidation of ethylene with molecular oxygen provided as an oxygen-containing gas at a temperature of from about 200 [degrees] C. to 300 [degrees] C. in the presence of at least about one mole percent of carbon dioxide and an organic chloride in the gaseous feed stream and in the presence of a supported, silver-containing catalyst in a fixed bed, tubular reactor used in commercial operations to form ethylene oxide, wherein said supported, silver-containing catalyst contains 2 to 20 weight percent silver deposited on a support which is in a form and size for use in the reactor, wherein (i) the specific reaction conditions of the ethylene oxide [*9] process; (ii) the specific catalyst support characteristics and (iii) the specific silver deposition method comprise an ethylene oxide production system, the improvement in which the catalyst comprises silver deposited on an alpha-alumina macroporous support in a first amount having a surface area less than 10 m²/g and contains a combination of (a) cesium in a second amount and (b) at least one other alkali metal selected from the group consisting of lithium, sodium, potassium and rubidium in a third amount, which combination comprises (a) and (b) in amounts in relation to the amount of silver in the catalyst sufficient to provide an efficiency of ethylene oxide manufacture that is greater than the efficiencies obtainable in the same ethylene oxide production system, including the same conversions, than (i) a second catalyst containing silver in the first amount and cesium in the second amount, and (ii) a third catalyst containing silver in the first amount and the alkali metal in the third amount, wherein the combination of silver, cesium and alkali metal in said catalyst is characterizable by an efficiency equation:

[See formula in printed version]

where BA[1] =BRb,

BA[2]=BK, [*10]

BA[3]=BNa,

BA[4]=BLi, and where the coefficient b[0] through b[9j] and BG, BRb, BK, BNa, BLi and BCs are determined from a composite design set of experiments using the same ethylene oxide production system for the independent variables silver, cesium and alkali metal, and wherein BG is the difference of the average value of the silver content from the silver content used in the design set, BCs is the difference of the average value of the cesium content from the cesium content used in the design set . . . and BLi is the difference of the average value of the lithium content from the lithium content used in the design set.

4. The process of claim 1 wherein said alkali metal is lithium.

('243 patent, col. 29, ln. 53 - col. 30, ln. 54)

In summary, claim 4 has four basic limitations, each containing various requirements: n7 (1) an EO process operated at specific reaction conditions; n8 (2) the catalyst used in the EO process comprises silver in a first amount, cesium in a second amount, and lithium in a third amount; (3) the efficiency obtainable from the EO process using the catalyst is greater than the efficiency of a process using (a) a second catalyst [*11] containing silver in the first amount and cesium in the second amount (but no lithium) and (b) a third catalyst containing silver in the first amount and lithium in the third amount (but no cesium), when operated in the same EO production system (the "comparison test"); and (4) the combination of silver, cesium and lithium is characterizable by the efficiency equation set fourth in claim 1 (the "characterizable test"). n9

n7 The court notes that while claim 4 is the only claim at issue, its limitations are substantially defined by claim 1. Consequently, throughout this memorandum the court's analysis frequently refers to claim 1.

n8 The '243 patent lists ten specific commercial reaction conditions. (D.I. 625 at 410-13)

n9 The characterizable test is an example of a statistical approach to comprehensive catalyst optimization. (D.I. 625 at 310; PTX 1079) Union Carbide's expert explained the efficiency equation as "a mathematical relationship between the

amount of cesium and the amount of lithium that predicts the efficiency, correlates, actually, the change in efficiency with variations of cesium and lithium." (D.I. 625 at 419-20; '243 patent, col. 8 ln. 65 - col. 9 ln. 5)

[*12]

B. Federal Circuit's Claim Construction

The Federal Circuit describes the equation outlined in claim 1, upon which claim 4 depends, as "not a patented process for developing a synergistic catalyst but rather a descriptive tool that defines the scope of the patented invention: silver catalysts containing cesium and lithium in a combination that provides a synergistic, rather than an antagonistic or additive, effect." *Union Carbide*, 308 F.3d at 1178. Consequently, the Federal Circuit construed claim 1's limitation that the catalyst be "characterizable by an efficiency equation" to mean that "the claim limitation covers those catalysts that are described by the efficiency equation" or "capable of being described by an efficiency equation." *Id.* at 1178-79.

III. MOTIONS FOR JUDGMENT AS A MATTER OF LAW OR, IN THE ALTERNATIVE, FOR A NEW TRIAL.

Prior to submission of the case to the jury, Union Carbide and Shell each entered numerous motions, both oral and by written brief, for judgment as a matter of law. Where the jury's verdict was unfavorable, both parties have renewed post-trial their motions for judgment as a matter of law. These [*13] motions include the following: (1) Shell's motion for judgment as a matter of law and alternative motion for new trial on Union Carbide's claim of direct infringement (D.I. 605; D.I. 647-1; D.I. 647-2); (2) Shell's motion for judgment as a matter of law and alternative motion for new trial on Union Carbide's claim of contributory infringement (D.I. 609; D.I. 645-1; D.I. 645-2); (3) Union Carbide's motion for judgment as a matter of law on wilfulness (D.I. 662); (4) Shell's renewed motion for judgment as a matter of law and alternative motion for new trial on its invalidity defenses of anticipation and obviousness (D.I. 617; D.I. 651-1; D.I. 651-2); (5) Shell's motion for judgment as a matter of law and alternative motion for new trial on Shell's invalidity defense of indefiniteness (D.I. 611; D.I. 653-1; D.I. 653-2); (6) Shell's motion for judgment as a matter of law and alternative motion for a new trial on its invalidity defense of non-enablement (D.I. 613; D.I. 657-1; D.I. 657-2); and (7) Shell's motion for judgment as a matter of law on UCCPTC's claims for damages and alternative motion for a new trial or remittitur on the jury's damages verdict (D.I. 607; D.I. 655-1; D.I. 655-2). [*14]

A. Standards of Review

1. Judgment as a Matter of Law

To prevail on a renewed motion for judgment as a matter of law following a jury trial, the moving party "must show that the jury's findings, presumed or express, are not supported by substantial evidence or, if they were, that the legal conclusions implied [by] the jury's verdict cannot in law be supported by those findings." *Pannu v. Iolab Corp.*, 155 F.3d 1344, 1348 (Fed. Cir. 1998) (quoting *Perkin-Elmer Corp. v. Computervision Corp.*, 732 F.2d 888, 893 (Fed. Cir. 1984)). "Substantial" evidence is such relevant evidence from the record taken as a whole as might be acceptable by a reasonable mind as adequate to support the finding under review." *Perkin-Elmer Corp.*, 732 F.2d at 893. In assessing the sufficiency of the evidence, the court must give the non-moving party, "as [the] verdict winner, the benefit of all logical inferences that could be drawn from the evidence presented, resolve all conflicts in the evidence in his favor, and in general, view the record in the light most favorable to him." *Williamson v. CONRAIL*, 926 F.2d 1344, 1348 (3d Cir. 1991); [*15] *Perkin-Elmer Corp.*, 732 F.2d at 893. The court may not determine the credibility of the witnesses nor "substitute its choice for that of the jury between conflicting elements of the evidence." *Perkin-Elmer Corp.*, 732 F.2d at 893. In sum, the court must determine whether the evidence reasonably supports the jury's verdict. See *Dawn Equip. Co. v. Ky. Farms Inc.*, 140 F.3d 1009, 1014 (Fed. Cir. 1998).

2. Motion for a New Trial

Federal Rule of Civil Procedure 59(a) provides, in pertinent part:

A new trial may be granted to all or any of the parties and on all or part of the issues in an action in which there has been a trial by jury, for any of the reasons for which new trials have heretofore been granted in actions at law in the courts of the United States.

Fed. R. Civ. P. 59(a). The decision to grant or deny a new trial is within the sound discretion of the trial court and, unlike the standard for determining judgment as a matter of law, the court need not view the evidence in the light most favorable to the verdict winner. See *Allied Chemical Corp. v. Daiflon, Inc.*, 449 U.S. 33, 36, 66 L. Ed. 2d 193, 101 S. Ct. 188 (1980); [*16] *Olefins Trading, Inc. v. Han Yang Chem. Corp.*, 9 F.3d 282 (3d Cir. 1993); *LifeScan Inc. v. Home Diagnostics, Inc.*, 103 F. Supp. 2d 345, 350 (D. Del. 2000), *aff'd per curiam*,

Nos. 00-1485, 00-1486, 13 Fed. Appx. 940, 2001 WL 345439 (Fed. Cir. Apr. 6, 2001) (citations omitted). Among the most common reasons for granting a new trial are: (1) the jury's verdict is against the clear weight of the evidence, and a new trial must be granted to prevent a miscarriage of justice; (2) newly-discovered evidence exists that would likely alter the outcome of the trial; (3) improper conduct by an attorney or the court unfairly influenced the verdict; or (4) the jury's verdict was facially inconsistent. See *Zarow-Smith v. N.J. Transit Rail Operations*, 953 F. Supp. 581, 584 (D.N.J. 1997) (citations omitted). The court must proceed cautiously, mindful that it must not substitute its own judgment of the facts and the credibility of the witnesses for those of the jury. The court should grant a new trial on the basis that the verdict was against the weight of the evidence only where a miscarriage of justice would result if the verdict were to stand. See [*17] *Williamson*, 926 F.2d at 1352; *EEOC v. Del. Dep't of Health and Soc. Servs.*, 865 F.2d 1408, 1413 (3d Cir. 1989).

B. Direct Infringement

Shell filed a motion for judgment as a matter of law or, in the alternative, for a new trial, contending that Union Carbide failed to provide a legally sufficient evidentiary basis for a reasonable jury to conclude that Shell literally infringed claim 4 of the '245 patent directly. n10 Shell alleges the following basis for its motion on direct infringement: (1) Union Carbide did not conduct its tests of Shell's catalysts at the "same conversions;" (2) Union Carbide did not vary silver in the design set of experiments; (3) Union Carbide did not conduct the characterizable test and comparison test in the "same ethylene oxide production system;" (4) Union Carbide failed to prove infringement because the differences in efficiencies are within experimental error; (5) Union Carbide did not properly prepare Shell's catalysts; and (6) Union Carbide did not properly test Shell's rhenium catalysts.

n10 Shell originally filed a motion for judgment as a matter of law on direct infringement on November 3, 2003, prior to submission of the case to the jury. (D.I. 605) Shell filed its renewed motion on December 22, 2003. (D.I. 647)

[*18]

1. Same Conversion

The comparison test of claim 1 of the '243 patent requires "an efficiency of ethylene oxide manufacture that is greater than the efficiencies obtainable in the same

ethylene oxide production system, including the same conversions." ('243 patent, col. 30, 11. 9-12) Union Carbide's expert testified that he maintained the same conversion by measuring EO in the outlet. (D.I. 626 at 562-569) Based upon the specification's definition of conversion, Shell contends that Union Carbide's expert should have conducted his experiment by measuring whether ethylene conversion was constant rather than measuring EO in the outlet. (D.I. 648 at 9-10) It is not disputed that the '243 patent, its prosecution history and the prior art recognize that catalyst efficiencies may be compared at constant EO in the outlet, constant oxygen conversion, or constant ethylene conversion. ('243 patent, col. 11, 11. 14-21; JTX 4 at 112-13, 128-29; JTX 7 at 101, 113-15, 534-35; D.I. 625 at 509-10; D.I. 648 at 9) Moreover, as Union Carbide's infringement expert explained, once efficiency is determined by any of these three measurements, obtaining the conversion rate of the other two is a matter [*19] of basic stoichiometry. n11 (D.I. 526 at 512) Union Carbide's use of EO in the outlet was not improper and was evidence by which a reasonable jury could find direct infringement.

n11 In presenting its defense, Shell itself argued the propriety of performing such calculations. (D.I. 627 at 857, 859, 917-19)

2. Variance of Silver

The plain language of the claim at issue requires that the combination of silver, cesium and lithium in a catalyst used in an accused process be "characterizable" by a particularly defined efficiency equation. Claim 1 further requires that the coefficients of the efficiency equation be determined by testing catalysts in a composite design set of experiments which must include, as independent variables, silver, cesium and lithium. ('243 patent, col. 30, 11. 16-54) Shell contends that claim 1 requires that the amounts of silver be varied to determine the silver-related coefficients of the efficiency equation. (D.I. 648 at 13) Shell did not seek a jury instruction that claim 1 required [*20] that silver actually be varied to prove literal infringement. Conversely, Union Carbide contends that, as the actual amount of silver in the Shell catalysts was a known factor, it was not necessary for purposes of proving infringement to use varying amounts of silver. The plain language of claim 1 does not require silver to actually be varied. The jury heard conflicting expert testimony from both parties concerning this issue. The court finds that there was sufficient evidence by which a reasonable jury could conclude that proof of infringement did not require that silver actually be varied in order to satisfy the characterizable test limitation.

3. Appropriate Reaction Conditions

Claim 1 requires that the comparison test and characterizable test be conducted in the "same ethylene oxide production system" which, as the court instructed the jury, means "the laboratory or experimental 'conditions and parameters' which define the ethylene oxide production system which ultimately will be used commercially." ('243 patent, col. 30, 11. 4-54; D.I. 601) Shell contends that this should mean the "specific reaction conditions of each commercial ethylene oxide process." (D.I. 648 at 15) [*21] As Shell's own brief reflects, its argument rests upon its interpretation of claim 1. (D.I. 696 at 11) The plain language of claim 1 and this court's construction thereof do not require that the specific reaction conditions of each commercial process be tested, only that the laboratory conditions and parameters define the process ultimately used. In the present case, sufficient evidence is in the record by which a reasonable jury could conclude that Union Carbide's expert's testing procedures were consistent with the requirements of "same ethylene oxide production system." (D.I. 625 at 444-57; D.I. 626 at 578-87; PTX 1101)

4. Range of Experimental Error

Shell contends that the differences in efficiency with respect to tests performed on Shell's catalysts by Union Carbide's expert were less than 1.31% and were within the range of experimental error for the comparative efficiency test. (D.I. 648 at 20) Consequently, Shell contends that the efficiency differences relied upon were not statistically significant. Statistical significance, however, is a question of fact for the jury as it is an issue of evidentiary weight. The jury heard evidence by which they could conclude that [*22] the efficiency differences achieved were statistically significant. (PTX 2227; D.I. 625 at 473) Consequently, the court finds the records reasonably supports the jury's findings.

5. Preparation of Shell Catalysts

Shell contends that the Union Carbide expert's test catalysts were not representative of Shell's cesium-optimized catalysts and, therefore, no jury could conclude that the Shell catalysts infringe the '243 patent. The jury heard evidence that the amount of cesium used by Union Carbide's infringement expert was the optimum amount. (D.I. 625 at 438-439; PTX 331; D.I. 627 at 887-88; D.I. 628 at 1383-84) This was, therefore, an issue of disputed fact for the jury to resolve. Consequently, the court finds that there was sufficient evidence for a reasonable jury to conclude that the Union Carbide expert's tests were properly performed. Shell is not entitled to judgment as a matter of law.

6. Testing of Shell's Rhenium Catalysts

Shell contends that, with respect to the rhenium catalysts, Union Carbide's expert failed to properly optimize the chloride inhibitor and failed to properly pretreat the catalysts. (D.I. 648 at 21-22) The jury, however, heard testimony that [*23] the amount of chloride inhibitor used with the catalysts depends primarily on the amount of rhenium present. Union Carbide's expert testified that he optimized this amount consistent with the catalyst's requirements. (D.I. 628 at 1386; D.I. 625 at 450; D.I. 629 at 1387-88) Union Carbide's expert also testified that the pretreatment of rhenium catalysts with nitrogen was not required under the conditions at which his tests were performed. (D.I. 628 at 1380) Consequently, the jury heard sufficient evidence to support their finding that the Union Carbide expert's testing of the rhenium catalysts was proper and, therefore, supporting of a finding of infringement.

Accordingly, the court finds that Shell has failed to meet its burden with respect to its judgment as a matter of law on the claim of direct infringement. For the reasons stated above, the court also declines to find that the jury's verdict was against the clear weight of the evidence such that it shocks the court's conscience and, therefore, a new trial is not warranted. Shell's motions for judgment as a matter of law, or in the alternative, for a new trial will be denied. (D.I. 605; D.I. 647-1; D.I. 647-2)

C. Contributory [*24] Infringement

The jury returned a verdict finding Shell liable for contributory infringement of the '243 patent. (D.I. 602) Shell, in its motion for judgment as a matter of law, asserts the following arguments: (1) failure of proof with respect to a predicate act of direct infringement; (2) failure of proof with respect to the absence of substantial noninfringing use; (3) failure of proof with respect to CRI's knowledge of customers infringing uses of the catalysts. Alternatively, Shell moves for a new trial on the following bases: (1) the jury verdict form was erroneous; (2) the jury instructions were erroneous; and (3) the exclusion of *U.S. Patent No. 5,057,481* ("the '481 patent") was substantially prejudicial. (D.I. 646)

Section 271(c) provides for secondary liability for infringement of a United States Patent. To prove contributory infringement a plaintiff must demonstrate the following: (1) an offer to sell, sale, or import; (2) a component or material for use in a patented process constituting a material part of the invention; (3) knowledge by the defendant that the component is especially made or especially adapted for use in an infringement of such patent; and (4) the component [*25] is not a staple or article suitable for substantial noninfringing use. 35 U.S.C. § 271(c). Further, contributory infringement generally requires proof of

actual direct infringement by a customer of the defendant. See *Novartis Pharmaceuticals Corp. v. Eon Labs Mfg., Inc.*, 363 F.3d 1306, 1308 (Fed. Cir. 2004). However, if use of the component by the defendant's customers necessarily infringes the patent, actual proof of an instance of direct infringement is not required. *Dynacore Holdings Corp. v. U.S. Philips Corp.*, 363 F.3d 1263, 1275-76 (Fed. Cir. 2004).

1. Predicate Act of Direct Infringement

In its motion and brief related to contributory infringement, Shell renews its arguments pertaining to direct infringement of the '243 patent. For the reasons discussed above, the court finds that a reasonable jury could conclude that there was an occurrence of a predicate act of direct infringement. See *infra* Part IV.B.

2. Substantial Noninfringing Use

Shell contends that the tests conducted by Union Carbide's expert cannot be proof of the absence of substantial noninfringing use, as Union Carbide's expert did not [*26] test the catalysts at the specific reaction conditions used in the commercial process at issue. (D.I. 646 at 26) Union Carbide's expert testified that his tests demonstrated that the processes actually used by CRI customers would infringe the '243 patent. (D.I. 625 at 456-57) Union Carbide's expert explained that at different process conditions than those he used, the accused catalysts would still have an increased efficiency as required by the claims and would still meet the efficiency equation. (Id. at 479-80) The testimony of Union Carbide's expert is evidence that there is not a substantial noninfringing use of the Shell catalysts. Shell asserts that there are numerous conditions under which the catalysts may be used commercially and would not infringe but offered no evidence to the jury to that effect. Substantial noninfringing use is a question of fact for the jury and the Union Carbide expert's unrefuted testimony was sufficient evidence thereof.

3. CRI's Knowledge of Customers' Infringing Uses

Shell contends that Union Carbide failed to offer proof of the requisite knowledge for liability under 35 U.S.C. § 271(c). (D.I. 646 at 27) In so arguing, [*27] Shell renews arguments previously made at trial and rejected by the court. Shell contends that to be liable for contributory infringement, the law requires that CRI knew when it sold its catalysts to customers that the use of the catalysts in its customers' processes would infringe the '243 patent. n12 (D.I. 646 at 11)

n12 Union Carbide admitted that if "the law requires that Shell had knowledge that their

catalysts met the efficiency equation there is no evidence that they had that knowledge." (D.I. 629 at 1466-67)

In *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, the Federal Circuit Court of Appeals described § 271(c) as requiring "proof of a defendant's *knowledge*, not *intent*, that his activity cause[s] infringement." 909 F.2d 1464, 1469 (Fed. Cir. 1990) (emphasis in original). This knowledge, according to the Court of Appeals, is a knowledge of both the component's particular use and "knowledge of the patent which proscribed that use." *Id.* at 1469 n.4. Consistent with [*28] the court's interpretation of controlling authority, the jury was instructed that a finding of contributory infringement required proof that CRI acted "with knowledge that the component was especially made for use in a manner that infringes claim 4 of the '243 patent." (D.I. 601 at 21) Consequently, to the extent Shell's motion depends upon an interpretation of § 271(c) inconsistent with this court's jury instructions, its motion for a judgment as a matter of law will be denied. (D.I. 609, D.I. 645-1)

In the alternative, Shell moves for a new trial contending that the jury verdict form was erroneous, the jury instructions were erroneous and that the exclusion of the '481 patent was substantially prejudicial. The '481 patent was an issue determined by the court during pretrial evidentiary rulings. ((D.I. 561) The verdict form was the subject of oral argument during the charge conference. (D.I. 628 at 1451-56; D.I. 629 at 1471-72) As Shell's motion depends upon arguments already rejected by the court, its motion for a new trial is denied. (D.I. 647-2)

D. Willfulness

Prior to submission of the case to the jury, Union Carbide orally moved for judgment as a matter of law on the [*29] issue of willful infringement. (D.I. 628 at 1396) The court declined to consider the motion and submitted it to the jury. The jury returned a verdict finding that Union Carbide had not shown by clear and convincing evidence that Shell had willfully infringed the '243 patent. On December 22, 2003, Union Carbide renewed its motion for judgment as a matter of law on willful infringement. (D.I. 662)

As grounds for its motion, Union Carbide asserts that it was undisputed that Shell had knowledge of the '243 patent prior to beginning to use or sell the Shell catalysts and that Shell lacked a good faith basis to believe that its uses or sales were not infringements thereof. (Id.) The jury heard evidence that Dr. Clendenen, a Ph.D. chemical engineer and patent attorney, was responsible for monitoring the technical aspects of Shell's catalyst business. (D.I. 625 at 360, 366,

790, 1092) Dr. Clendenen testified that he reviewed PTO publications for patents issued in the area for which he was responsible. He also reported patents which might require a legal opinion with respect to noninfringement. Dr. Clendenen testified that he reviewed the '243 patent and, in his opinion, determined that [*30] it did not require further action by Shell. (Id. at 371-72) Dr. Clendenen never sought further action on the '243 patent and never told any other business person or decision maker at Shell about his belief. (Id. at 369-70; D.I. 627 at 1108, 1111) Shell, therefore, did not seek a legal opinion on the '243 patent. In light of Dr. Clendenen's testimony, the court finds there to be sufficient evidence by which a reasonable jury could conclude that Union Carbide did not meet its burden of proof. Union Carbide's motion for judgment as a matter of law on willfulness will be denied. (D.I. 662)

E. Non-Enablement

At the close of evidence and before submission of the case to the jury, Shell moved for judgment as a matter of law on its invalidity defense that claim 4 of the '243 patent is not enabled. (D.I. 613) The court declined to rule on Shell's motion and the jury returned a verdict finding the '243 patent to be valid. Post-trial, Shell renewed its motion for judgment as a matter of law that the '243 patent is invalid for lack of enablement. (D.I. 657) Shell contends that claim 4 of the '243 patent is not enabled for two reasons: (1) it requires undue experimentation to practice; [*31] and (2) it is inoperable. (D.I. 658)

Section 112 of the Patent Act states:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same.

35 U.S.C.A. § 112. A patent is not enabled if it does not teach a person skilled in the art "to make and use the invention without undue experimentation." *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988). "The determination of what constitutes undue experimentation in a given case requires the application of a standard of reasonableness, having due regard for the nature of the invention and the state of the art." *Id.* Several factors may be considered in determining whether experimentation is undue, including: (1) the quantity of

experimentation necessary; (2) the amount of direction or guidance presented; (3) the presence or absence of working examples; (4) the nature of the invention; (5) the state of the prior art; (6) the relative skill of those [*32] in the art; (7) the predictability or unpredictability of the art; and (8) the breadth of the claims. See *id.* (quotations omitted).

Shell contends that the '243 patent requires undue experimentation because, "to fully enable the invention of claim 4, one would have to conduct the requisite tests to determine whether [the comparison test and characterizable test] were met and would have to conduct those requisite tests at every possible combination of reaction condition variables within the broad ranges of the preamble of claim 1." (D.I. 658 at 9) The jury, however, was presented with evidence that undue experimentation was not required. (D.I. 625 at 306-09, 460-62; D.I. 626 at 825-32)

Shell also contends claim 4 is inoperable, alleging that the "efficiency of an EO process using a catalyst containing silver, cesium, and lithium can never be greater than the efficiency of a process using a silver and cesium-only catalyst, or a silver and lithium-only catalyst, as required by claim 4." (D.I. 658 at 12) Shell's argument is one of fact that was resolved by the jury. The jury heard substantial evidence that Shell's catalysts showed that lithium increases efficiency. (D.I. 625 at [*33] 460-62) While Shell's experts dispute the conclusions of Union Carbide's expert, the jury resolved the dispute in Union Carbide's favor.

Consequently, the court finds that there was legally sufficient evidence for a reasonable jury to conclude that Shell did not prove its defense of nonenablement by clear and convincing evidence. Further, for the reasons stated above, the jury's verdict is not against the clear weight of the evidence such that it shocks the conscience of the court. Therefore, Shell's motion for judgment as a matter of law and, in the alternative, for a new trial will be denied. (D.I. 613; D.I. 657-1; D.I. 657-2)

F. Indefiniteness

At the close of evidence, Union Carbide, by oral motion, moved for judgment as a matter of law on Shell's defense of indefiniteness. (D.I. 628 at 1397) Shell also moved for judgment as a matter of law that claim 4 of the '243 patent was indefinite as a matter of law. (D.I. 611) That motion was renewed post-trial by Shell or, in the alternative, for a new trial. (D.I. 653)

After the presentation of evidence was completed, the court found that Shell had failed to adduce direct evidence creating a disputed issue of fact as to whether [*34] claim 4 is indefinite. n13 (D.I. 628 at 1447) Consequently, the court declined to send Shell's defense

of claim indefiniteness to the jury. (*Id.* at 1450) In so concluding, the court granted Union Carbide's oral motion for judgment as a matter of law that the '243 patent is not invalid for reason of claim indefiniteness and implicitly denied Shell's motion. n14 Consequently, the court shall construe Shell's renewed motion for judgment as a matter of law as a motion for reconsideration. (D.I. 612 at 2)

n13 Shell's enablement and indefiniteness defense, however, largely relied upon DTX 14, which the court precluded from evidence when it granted one of Union Carbide's motions in limine. (D.I. 561 at P18; D.I. 488)

n14 The court notes that the record is unclear as initially the court stated that it would reserve judgment and did not make it explicit on the record that the oral motion was granted. (D.I. 628 at 1400; 1450)

A motion for reconsideration may be entertained to "correct manifest errors of law or [*35] fact or to present newly discovered evidence." *Max's Seafood Cafe ex-rel. Lou-Ann, Inc. v. Quinteros*, 176 F.3d 669, 677 (3d Cir. 1999). Accordingly, a court may alter or amend its judgment if the movant demonstrates at least one of the following: (1) a change in the controlling law; (2) availability of new evidence not available when summary judgment was granted; or (3) a need to correct a clear error of law or fact or to prevent manifest injustice. See *id.*

The Patent Act requires patent claims to "particularly point out and distinctly claim the subject matter which the applicant regards as his invention." 35 U.S.C. § 112. Indefiniteness is a question of law. See *Personalized Media Communs., L.L.C. v. ITC*, 161 F.3d 696, 705 (Fed. Cir. 1998). In a jury trial, if there are disputed factual issues related to indefiniteness, they may be submitted to the jury for resolution. See e.g., *BJ Servs. Co. v. Halliburton Energy Servs.*, 338 F.3d 1368, 1372 (Fed. Cir. 2003). As a patent is presumed valid, a party asserting a defense of invalidity on the basis of claim indefiniteness has the burden of [*36] proof by clear and convincing evidence. See *Orthokinetics, Inc. v. Safety Travel Chairs, Inc.*, 806 F.2d 1565, 1575-76 (Fed. Cir. 1986).

Shell presents three arguments for indefiniteness: (1) the use of a catalyst can simultaneously infringe or not infringe depending on the reaction conditions to test for infringement; (2) the test results of any catalyst would vary depending on the interpretation of conversion; (3) the absence of a criterion to determine whether a

combination of silver, cesium and lithium is characterizable by the efficiency equation. (D.I. 654)

1. Effect of Reaction Conditions

In its first argument for indefiniteness, Shell asserts that the comparison test can be met using any set of reaction conditions within the broad range set forth in the preamble of claim 1 and, therefore, infringement will exist or not exist depending upon the particular reaction conditions selected by the party seeking to examine infringement. (D.I. 654 at 6-7) Union Carbide's evidence showed that, while the absolute value of efficiency measurements would change based upon the reaction conditions, the relative efficiencies would not. (D.I. 625 at 330-31, 478-80) Consequently, [*37] although a catalyst's absolute efficiency value may change at different test conditions, its comparative efficiency would not. (Id.) Shell, which bore the burden of proof on this issue, presented no evidence to contradict Union Carbide and, as a consequence, its defense of indefiniteness on these grounds fails as a matter of law.

2. Interpretation of Conversion

Shell next argues that claim 1, upon which claim 4 depends, is indefinite because test results of a catalyst would vary depending upon the measurement of conversion. (D.I. 654 at 12-14) Shell's argument, in this regard, regurgitates an argument it makes relating to direct infringement. For those reasons already discussed, the court finds Shell's defense of indefiniteness on these grounds fails. See *infra* Part III.B.1 (discussing measurement of conversion for purposes of determining infringement).

3. Criterion to Determine Whether Characterization Test Is Met

Shell's final argument for claim indefiniteness asserts that claim 1, upon which claim 4 depends, is indefinite because one of ordinary skill in the art would not know how to determine whether a combination of cesium, lithium and silver would meet [*38] the characterizable test. (D.I. 654 at 14-15) Union Carbide's expert explained that using widely known statistical regression analysis, in particular R-squared, a person may determine how well test data is represented by a mathematical equation. (D.I. 625 at 423-24) Union Carbide's expert used this form of statistical analysis to determine whether Shell's catalysts were characterizable by the efficiency equation in claim 1. (D.I. 625 at 465-68) Moreover, the '243 patent itself discloses the use of such methods in the written description and describes them as routine. ('243 patent, col. 11, 11. 28-41) Failure to specify a particular means of measurement does not render a claim indefinite where a person of ordinary skill in the art would, nevertheless, be able to practice the

invention. See *PPG Industries, Inc. v. Guardian Industries Corp.*, 75 F.3d 1558, 1563 (Fed. Cir. 1996). Shell presented no evidence to contradict the Union Carbide expert's assertion that R-squared provides an appropriate means of determining infringement or even to suggest that another method would be more appropriate. Consequently, the '243 patent's failure to specify a particular measurement method [*39] does not render it invalid.

Shell bore the burden of proof on its invalidity defense of claim indefiniteness, a burden which was not met. Therefore, the court's granting of judgment as a matter of law in favor of Union Carbide on this issue during the charging conference was proper as a matter of law. As Shell's arguments fail to show a clear error of law in the court's decision, Shell's motion for reconsideration shall be denied. (D.I. 653)

G. Anticipation and Obviousness

At the close of evidence, Shell moved for judgment as a matter of law on its invalidity defenses of anticipation and obviousness. (D.I. 618) The court declined to rule on Shell's motion and the case was submitted to the jury. The jury found that Shell did not prove by clear and convincing evidence that the '243 patent is invalid due to anticipation or obviousness. Shell has renewed its motion for judgment as a matter of law or, in the alternative, for a new trial. (D.I. 651)

1. Anticipation

Shell argues that the '243 patent is anticipated by *United States Patent No. 4,212,772*, and *Belgium Patent No. 867,045* (collectively "the Mross patents"). The defense of invalidity due to anticipatory prior art [*40] requires proof by clear and convincing evidence that a single prior art reference discloses all of the limitations of the claim at issue. See 35 U.S.C. § 102; *Minnesota Mining & Mfg. Co. v. Johnson & Johnsons Orthopaedics, Inc.*, 976 F.2d 1559, 1565 (Fed. Cir. 1992). Even where the prior art reference does not expressly disclose a limitation of a claim at issue, a jury may find that the prior art inherently discloses the limitation. See *Atlas Powder v. IREOCO Inc.*, 190 F.3d 1342, 1347 (Fed. Cir. 1999).

In the present case, in order to find that the Mross patents anticipated the '243 patent, a jury would have to find that the catalyst disclosed in the Mross patent (the "L1 catalyst") was an inherent disclosure of claim 1's characterizable test limitation. The jury heard evidence that, from Shell's expert's own results, the L1 catalyst is not characterizable by the efficiency equation. (D.I. 627 at 1051, 1090-91; D.I. 628 at 1389-90) As there was legally sufficient evidence for a reasonable jury to conclude that there was not clear and convincing

evidence that the Mross patents anticipate the '243 patent, Shell's motion for [*41] judgment as a matter of law on anticipation will be denied. (D.I. 617; D.I. 651-1)

2. Obviousness

The defense of invalidity due to obviousness under the prior art requires proof by clear and convincing evidence that the differences between the claimed invention and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the relevant field. 35 U.S.C. § 103(a). In determining whether a claimed invention is obvious, the finder of fact considers the following four factors: (1) scope and content of the prior art; (2) differences between the prior art and the claimed invention; (3) level of ordinary skill in the pertinent field; and (4) secondary considerations such as commercial success, long felt but unsolved needs, failure of others that may shed light on the circumstances surrounding the origin of the subject matter sought to be patented. See *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17-18, 15 L. Ed. 2d 545, 86 S. Ct. 684 (1966). See also *Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 716 (Fed. Cir. 1991). Where obviousness is based [*42] on a single prior art reference, a party seeking to invalidate a patent must show a "suggestion or motivation to modify the teachings of that reference." *In re Kotzab*, 217 F.3d 1365, 1370 (Fed. Cir. 2000).

Shell argues that even if the Mross patents do not anticipate the '243 patent, they are proof that the '243 patent is obvious. According to Shell, the prior art teaches that lithium is an effective promoter; therefore, it would have been obvious to a person skilled in the art that using lithium in combination with cesium on the L1 catalyst would result in an EO process of a higher efficiency than that of an EO process using a silver/cesium or a silver/lithium catalyst. (D.I. 652 at 19)

As there was no evidence of an express suggestion in the prior art, whether the prior art contained an inherent suggestion was an issue of fact for the jury. While Shell offered evidence that efficiency was the central objective of EO catalysts and that a person skilled in the art with knowledge of the Mross patents could have created a catalyst that satisfied the limitations of claim 4, the jury also heard evidence regarding the unexpected results, long-felt need and commercial [*43] success of the claimed invention. (D.I. 624 at 204-06, 246-67; D.I. 625 at 266, 270, 275-78; D.I. 626 at 674-76, 750-51) Consequently, the court finds that there was legally sufficient evidence by which a reasonable jury could conclude that Shell failed to prove by clear and convincing evidence that the '243 patent was invalid due to obviousness. (D.I. 611; D.I. 653-1) Further, to the

extent that Shell's motion depends upon arguments already discussed and rejected by the court, its motion for a new trial is denied. (D.I. 653-2)

H. Damages

Prior to submission of the case to the jury, Shell moved for judgment as a matter of law on Union Carbide's claims for damages. (D.I. 607) The court declined to rule on Shell's motion and the jury returned a verdict finding infringement and awarding \$ 112,198,893 in damages as a reasonable royalty. Shell has renewed its motion for judgment as a matter of law or, in the alternative, for a new trial or, in the alternative, for remittitur. (D.I. 655)

The parties agree that the appropriate measurement of damages in the present case is a reasonable royalty. A reasonable royalty is the amount a willing licensor and willing licensee would agree [*44] to in a hypothetical negotiation at the time infringement begins. See *Georgia-Pacific Corp. v. United States Plywood Corp.*, 318 F. Supp. 1116 (S.D.N.Y. 1970). The Georgia-Pacific factors include a wide variety of relevant factors which reasonable parties would take into consideration in a hypothetical negotiation. *Id.* at 1120.

The jury was given evidence that Shell's catalysts resulted in substantial savings on raw materials due to increased selectivity. (D.I. 625 at 682-83) The jury also heard evidence that Shell had used 5,102,436 pounds of the infringing catalysts internally. (D.I. 625 at 674-75; PTX 1094) At its own plants, this savings translated into approximately \$ 31 per pound of catalyst. (D.I. 625 at 674-75) The jury heard testimony showing that Shell realized a ten to thirty percent increase in production capacity, due to Shell's use at its own plants of the infringing catalysts. (*Id.* at 683-84) This increased production capacity resulted in a profit of approximately \$ 133 million or \$ 26 per pound of catalyst. Union Carbide's damages expert testified that at a hypothetical negotiation in 1993, the parties would have used the most [*45] conservative estimates of these savings and anticipated profits to reach a total value to Shell of \$ 41.27 per pound of catalyst used internally. (*Id.* at 686, 688-89, 692. Consequently, Union Carbide's damages expert testified that a reasonable royalty base would be \$ 20.63 per pound for Shell's internal infringing catalyst use, based upon a even sharing of the benefit to Shell. n15 (*Id.* at 697)

n15 Union Carbide's damages theory that a reasonable royalty base would be fifty percent of benefit Shell received from use of the infringing catalysts was supported by evidence of certain of Union Carbide's joint ventures. (D.I. 626 at 738)

The fifty percent figure was also supported by UCCPTC's practice of not licensing its catalyst technology due to the effect such licensing would have on Union Carbide's competitors' cost structures. (Id. at 610-12)

With respect to external sales, the jury heard evidence that Shell generated an average profit of \$ 12.82 per pound of its S-863, S-880 and S-882 catalysts. [*46] (Id. at 701) The jury also heard evidence that Shell had sold nearly 9,862,290 pounds of the infringing catalysts. (Id. at 674-75; PTX 1096) Consequently, based upon a fifty percent share of Shell's profits from its external sales, Union Carbide's expert testified that a reasonable royalty would be \$ 6.41 per pound of catalyst sold. (D.I. 625 at 702-03).

Although Union Carbide sought a reasonable royalty in the amount of fifty percent of Shell's profits from external sales and fifty percent of the estimated benefit from internal use, the jury awarded \$ 13.62 per pound used internally and \$ 4.23 per pound sold to third parties. (D.I. 629 at 1603)

The crux of Shell's argument is that some of the factors considered by Union Carbide's damages expert, and presented to the jury, were either irrelevant, improper and/or prejudicial. In particular, Shell contends the following should not have been considered as factors in a hypothetical negotiation: (1) harm to Union Carbide Corporation ("UCC") as opposed to Union Carbide Chemicals & Plastics Technology Corporation ("UCCPTC"); (2) evidence pertaining to Shell's profits for MEG production; (3) evidence related to third parties' use [*47] of Shell catalysts; and (4) evidence of Shell's external leases of catalysts.

The present case presented a problem of first impression for this court, namely, the extent to which the impact on a nonexclusive licensee may be a factor considered in a reasonable royalty analysis where the nonexclusive licensee is the parent corporation of the patent holder and the patent holder is solely a technology holding corporation. n16 Shell argues that such a factor, even if a pertinent consideration, is unduly prejudicial. The court recognizes the risk that such evidence may permit a patent holder, not entitled to lost profits as a remedy, to nevertheless seek damages based in part upon lost profits. At trial, Shell objected to testimony from Union Carbide's damages expert that inaccurately portrayed the hypothetical negotiation to be between Union Carbide and Shell rather than UCCPTC and Shell. (D.I. 626 at 654) The court sustained the objection and required Union Carbide to correct the record before the jury and to inform them that the expert's analysis included no numbers associated with Union Carbide's

potential lost profits. (Id. at 655-57) In reviewing the record, the court finds that [*48] the damages expert's analysis was properly based on a substantial number of factors and the impact on UCC, as a factor a hypothetical patent holder would consider, was only one component thereof. See *Rite-Hite Corp. v. Kelley Co., Inc.* 56 F.3d 1538, 1555 (Fed. Cir. 1995) ("The language of the statute requires 'damages adequate to compensate,' which does not include a royalty that a patentee who does not wish to license its patent would find unreasonable.").

n16 This issue has appeared more than once and in more than one form over the course of the two trials in this case. (D.I. 561 at P35)

The remainder of Shell's objections also relate to what factors were relevant to the determination of a reasonable royalty rate. n17 In the present case, the court finds that the factors relied upon by Union Carbide's damages expert were consistent with the Georgia-Pacific standards and, as such, may be properly considered by the jury in determining a reasonable royalty base. The court also concludes that [*49] the damages award was supported by legally sufficient evidence on which a reasonable jury could rely. Consequently, Shell's motion for judgment as a matter of law will be denied. (D.I. 607; D.I. 655-1)

n17 One of these factors, Shell's actual profits from MEG, has repeatedly been the subject of motion practice. (D.I. 269; D.I. 270; D.I. 561 at P36)

Where a jury's award of damages is clearly unsupported and/or excessive, it is within the court's discretion to reduce the award to the maximum amount a jury could reasonably find. See *Spence v. Board of Educ.*, 806 F.2d 1198, 1201 (3d Cir. 1986). See also *Gumbs v. Pueblo Int'l Inc.*, 823 F.2d 768, 772 (3d Cir. 1987). In the present case, the court does not find that the jury award is so excessive that it shocks the conscience. In the present case, while Union Carbide presented evidence that in a hypothetical negotiation it would have been entitled to fifty percent of Shell's profits from its use and sale of the infringing catalysts, [*50] the jury concluded that thirty-three percent was an appropriate royalty. See *Rite-Hite Corp.*, 56 F.3d at 1555 (holding that it was "not unreasonable for the district court to find that an unwilling patentee would only license for one-half its expected lost profits and that such an amount was a reasonable royalty."). Viewing the evidence in the light most favorable to Union Carbide and giving Union

Carbide the benefit of all reasonable inferences thereof, there is legally sufficient evidence to support the jury's award.

Consequently, Shell's motion for remittitur is denied. The court also finds that Shell has failed to establish that the verdict is against the great weight of the evidence such that it shocks the conscience and, therefore, its motion for a new trial will also be denied. (D.I. 655-2)

In reviewing the jury's verdict on damages, however, the court found that the total damages awarded by the jury were inconsistent with their determination as to the reasonable royalty rate. n18 Based upon the undisputed evidence regarding the number of pounds of catalyst actually sold or used by Shell, the jury's royalty rate and total damages do not bear a mathematical [*51] relationship. n19 (D.I. 2197) While neither party raised this issue in its brief, it is well established the court has the inherent power to correct clerical errors in the record. *Fed. R. Civ. P. 60(a)*. This extends to include errors in jury arithmetic. See *U.S. for and on Behalf of Mississippi Road Supply Co. v. H. R. Morgan, Inc.*, 542 F.2d 262, 269 (5th Cir. 1976). Consequently, on its own motion the court will correct the verdict and judgment will be entered in the amount of \$ 111,212,665.02.

n18 Question seven of the jury verdict asked what "amount of damages do you find Union Carbide has proved by a preponderance of the evidence?" (D.I. 602) The jury responded with the figure of \$ 112,198,893. The jury then responded to questions eight and nine which asked for the reasonable royalty rate in dollars for Shell's internal use and external sales respectively. In response to question eight, the jury responded \$ 13.62 per pound. In response to question nine, the jury responded \$ 4.23. (Id.)

N19 The evidence showed that Shell used 5,102,436 pounds of catalyst internally and 9,862,290 pounds of catalyst externally. (D.I. 2197) Based upon the royalty rates determined by the jury, the amount of royalties owed by Shell would be \$ 69,495,178.32 for internal use and \$ 41,717,486.70 for external sales. Consequently, total damages based upon the royalty rate determined by the jury would be \$ 111,212,665.02 which is \$ 986,237.98 less than the amount reported on the jury sheet. As there is no rational explanation for this discrepancy, the court can only conclude that this resulted from mathematical error.

[*52]

IV. EQUITABLE ISSUES

On March 25, 2004, consistent with this court's practice, a bench trial was held on Shell's equitable defenses of laches and estoppel. (D.I. 700) Those equitable issues have been fully briefed and are ripe for decision. These are the court's findings of fact and conclusions of law pursuant to *Rule 52 of the Federal Rules of Civil Procedure*.

A. Laches

1. Shell contends that Union Carbide had actual and constructive knowledge of Shell's potentially infringing activities as early as April 1990 and that Union Carbide's delay in bringing suit was inexcusable and prejudicial as to Shell. (D.I. 786)

2. **Facts of Record.** In February 1988, representatives from Shell and Union Carbide met and discussed a new Shell catalyst which was reported to have "broken through the theoretical selectivity barrier" of 85.7%. (D.I. 628 at 1338-40) This high selectivity catalyst, S-879, contained cesium, lithium, rhenium and sulfur. (D.I. 626 at 808; DTX 274 at S334247) Shell disclosed that it did have a new high selectivity catalyst but that its life span was relatively short. (D.I. 628 at 1340-41) Shell did not disclose [*53] to Union Carbide at that time, or any other time prior to suit, the composition of the S-879 catalyst. (D.I. 1717-19, 1762-63)

3. In May 1998, Shell's European patent application for its rhenium based catalysts was first published, European Patent application 266,015 ("EPA '015"). In one of its sixty examples, the EPA '015 discloses a catalyst which exceeds the theoretical selectivity boundary of 85.7%. The preferred embodiment described in EPA '015 was a catalyst containing silver, rhenium and cesium only. (D.I. 700 at 1720-21)

4. Between August 1998 and February 1989, four more U.S. patents owned by Shell issued, including *U.S. Patent Nos. 4,761,394, 4,766,105, 4,808,738, and 4,820,675* (the "U.S. Lauritzen patents"). The Lauritzen patents were all based on applications filed on October 31, 1986. The U.S. Lauritzen patents all disclose catalysts that include rhenium in addition to at least one alkali metal. By at least July 1988, Union Carbide scientists had reviewed EPA '015. (D.I. 700 at 1615-16, 1781-83; DTX 69 at U0093338)

5. Between 1988 and 1995, Union Carbide monitored publicly available information regarding Shell's catalysts and their commercial performance. Union Carbide [*54] had information indicating that Shell's rhenium catalysts had longevity problems. (D.I. 700 at 1789-94)

6. The first commercial use of an infringing Shell catalyst, S-880, occurred in July 1993.

7. Representatives of Shell and Union Carbide met in October 1995 and discussed prospects for collaboration. (D.I. 700 at 1799-1801) At that meeting, Union Carbide raised the issue that Shell may be infringing one of three Union Carbide patents. (D.I. 628 at 1345-46) Shell indicated it was aware of the Union Carbide patents and denied infringement. (Id.; D.I. 700 at 1662-63, 1809) Following the meeting, Union Carbide continued to monitor available information about Shell's activities. (D.I. 700 at 1663)

8. In 1996, Union Carbide attended a presentation by a Shell scientist. (Id. at 1811-13) It was the impression of the Union Carbide representative that Shell's high selectivity catalysts were achieving efficiencies between 85-88%. (Id. at 1811-14)

9. In 1997, Union Carbide attended Shell's presentation at the Gordon Conference. (PTX 103 at U183745; D.I. 700 at 1814-17) Following the Gordon Conference, Union Carbide believed that the composition of Shell's high selectivity catalysts [*55] may infringe one or more Union Carbide patents, including the '243 patent. (D.I. 700 at 1815-18) Union Carbide began internally reviewing the information it had obtained. (Id. at 1664-69, 1818-19)

10. In October 1998, Union Carbide initiated discussions with Shell toward reaching an amicable resolution of the potential infringement issues. Discussions toward an amicable resolution failed when Shell filed a declaratory judgment suit.

11. Throughout the relevant period, Shell has actively guarded the composition of its catalysts. (Id. at 1765; PTX72 at S076322) CRI's catalyst customers were contractually prohibited from conducting tests on the catalysts. Prior to discovery in this litigation, Union Carbide did not have any access to Shell's catalysts.

12. **Conclusions of Law.** It is well established that laches is a defense to a patent infringement suit brought in equity. See *Lane & Bodley Co. v. Locke*, 150 U.S. 193, 37 L. Ed. 1049, 14 S. Ct. 78 (1893); *Wollensak v. Reiher*, 115 U.S. 96, 29 L. Ed. 350, 5 S. Ct. 1137, 1885 Dec. Comm'r Pat. 310 (1885); *Mahn v. Harwood*, 112 U.S. 354, 28 L. Ed. 665, 5 S. Ct. 174 (1884). *A.C. Aukerman Co. v. R.L. Chaides Const. Co.* 960 F.2d 1020, 1028 (Fed. Cir. 1992). [*56] "In a legal context, laches may be defined as the neglect or delay in bringing suit to remedy an alleged wrong, which taken together with lapse of time and other circumstances, causes prejudice to the adverse party and operates as an equitable bar." *A.C. Aukerman Co.*, 960 F.2d at 1028-29.

13. To prevail on its equitable defense of laches, Shell must prove by a preponderance of the evidence that: (1) Union Carbide delayed filing suit for an unreasonable and inexcusable period from the time that Union Carbide knew or should have known of its infringement claim against Shell; and (2) Union Carbide's delay operated to Shell's prejudice or injury. *Id.* at 1032.

14. The first prong of a laches defense requires proof that the patent holder had either actual or constructive knowledge of infringing activity. See *Johnston v. Standard Min. Co.*, 148 U.S. 360, 370, 37 L. Ed. 480, 13 S. Ct. 585 (1893); *Eastman Kodak Co. v. Goodyear Tire & Rubber Co.*, 114 F.3d 1547, 1559 (Fed. Cir. 1997). Constructive knowledge imposes upon patent holders the duty to police their rights. See *Wanlass v. General Electric Co.*, 148 F.3d 1334, 1338 (Fed. Cir. 1998). [*57] Under a constructive knowledge theory of laches, a patentee is charged with "such knowledge as he might have obtained upon inquiry, provided the facts already known by him were such as to put upon a man of ordinary intelligence the duty of inquiry." *Johnston*, 148 U.S. 360 at 370, 37 L. Ed. 480.

15. The defense of laches focuses on the conduct of the patentee, not the infringer. Nevertheless, the infringer's activities are relevant to whether the patentee's conduct was reasonable, including the infringer's efforts to maintain the secrecy of its processes and its denials of infringement. See *Eastman Kodak Co.*, 114 F.3d at 1559. An infringer can not cloak its activities in secrecy and simultaneously accuse the patent holder of failing to adequately protect its rights. See, e.g., *Fromson v. Western Litho Plate and Supply Co.*, 670 F. Supp. 861, 868-69 (E.D. Mo. 1987), rev'd on other grounds by 853 F.2d 1568 (Fed. Cir. 1988). n20

n20 Laches, and a property owner's duty to police its rights, are universal concepts in property law. In fact, a patentee's duty to inquire is directly attributed to trademark law. Compare *Potash Co. v. Int'l Minerals & Chem. Corp.*, 213 F.2d 153, 155 (10th Cir. 1954) with *Johnston*, 148 U.S. at 370. The requirement that only activities which are open and notorious can give rise to a subsequent defense of laches insures that a patentee's rights will not be diminished in secret.

[*58]

16. The court finds that there is no evidence that Union Carbide had actual knowledge that Shell's catalysts infringed the '243 patent. Therefore, Shell can only prevail on its laches defense if it can establish that

there were sufficient facts to warrant imputing constructive knowledge of Shell's infringing activities to Union Carbide and that Union Carbide's delay was unreasonable and inexcusable.

17. Where an infringer invokes the defense of laches based upon the patentee's constructive knowledge, the infringer must demonstrate that there were sufficient facts available to the patentee such that a duty to inquire arose. *Wanlass*, 148 F.3d at 1338. This duty to inquire commands that a patentee may not fail to police its property rights under circumstances where it has reason to suspect infringement. Circumstances which give rise to a duty to inquire must be "pervasive, open, and notorious" and include "sales, marketing, publication or public use of a product similar to or embodying technology similar to the patented invention, or published descriptions of the defendant's potentially infringing activities." *Id.* at 1339.

18. A patentee's duty to [*59] inquire is subject to a standard of reasonableness. As such, the extent to which a reasonable method of detection of infringement is available to the patentee is relevant. See *Wanlass*, 148 F.3d at 1334; *Wanlass v. Fedders Corp.*, 145 F.3d 1461, 1467 (Fed. Cir. 1998); *Hall v. Aqua Queen Mfg., Inc.*, 93 F.3d 1548 (Fed. Cir. 1996); *Imperial Chem. Mfg. Co. v. Stein*, 77 F. 612, 1897 Dec. Comm'r Pat. 285 (2d Cir. 1896).

19. As an initial matter, the court finds that Shell's activities occurring before July 1993, when S-880 was first commercially used, do not give rise to a duty to inquire. Any activities of Shell before that date can not be said to have put Union Carbide on notice as they were not, in fact, infringing activities. Moreover, it is also relevant that Shell's actual infringing activities were concealed.

20. As result of its continuing efforts to remain abreast of its competitors' activities and of advances in technology, Union Carbide was aware that in the early 1990s, Shell was attempting to commercialize a high selectivity catalyst. Based upon Shell's patents, Union Carbide's belief that these were rhenium based and not mixed alkali [*60] based was reasonable. The fact that some examples contained in certain Shell patents disclosed mixed alkali catalysts raises only a suggestion and is not sufficient evidence that Shell was infringing the '243 patent. Even when combined with the fact that it was known to Union Carbide that Shell was attempting to commercialize a high selectivity catalyst, these facts are not sufficient evidence by which a reasonable person would conclude that Shell was infringing or was likely infringing the '243 patent. Instead, these facts at most give rise to a suspicion.

21. Union Carbide's decision to pursue its suspicion by directly inquiring of Shell in 1995 was consistent with a patentee exercising reasonable diligence. It is contrary to principles of equity for Shell to affirmatively represent in 1995 that its activities were noninfringing and then permit it to subsequently assert laches as a defense when Union Carbide, at least in part, relied on Shell's representations. Otherwise, the duty to inquire essentially becomes a duty to sue upon suspicion. While it is true that Union Carbide did not need to know the actual composition of Shell's catalysts to bring suit, that does not mean that [*61] its prudence in bringing suit was unreasonable.

22. Under the circumstances of the present case, including the secret nature of Shell's infringing activities, Union Carbide's reasonable diligence in monitoring the market, and Shell's resistance to Union Carbide's efforts to ascertain whether Shell infringed the '243 patent, the court finds that Union Carbide's conduct was not unreasonable.

B. Equitable Estoppel

23. Shell contends that Union Carbide's failure to bring suit misled Shell to believe that Union Carbide would not bring suit and Shell detrimentally relied upon that belief.

24. **Conclusions of Law.** Equitable estoppel is similar to laches but focuses on the reasonableness of the infringer's reliance rather than the unreasonableness of the patentee's delay. To obtain relief from enforcement of a patent under the doctrine of equitable estoppel, the defendant must prove by clear and convincing evidence three elements: (1) the patentee, through misleading conduct, led the infringer to reasonably infer that the patentee did not intend to enforce its patent; (2) reliance by the infringer on the patentee's misleading conduct; (3) material prejudice to the infringer. [*62] See *A.C. Auckerman Co.*, 960 F.2d at 1028.

25. Having already concluded that Shell failed to prove that Union Carbide had actual knowledge of Shell's infringing activities, Shell's defense of equitable estoppel fails. Union Carbide could not have affirmatively misled Shell that it would not enforce its patents, if Union Carbide did not have knowledge of Shell's infringement. Consequently, the court finds that Shell's defense of equitable estoppel fails.

V. PREJUDGMENT INTEREST

Pursuant to 35 U.S.C. § 284, Union Carbide filed a motion for the award of prejudgment interest. (D.I. 661) Union Carbide seeks prejudgment interest at the prime rate compounded annually from July 1993 until the entry of judgment. n21 The prime rate for the relevant period

ranges from as low as 4% to as high as 9.5%. (D.I. 689, ex. A) Both parties seek a further expansion of the evidentiary record on this issue. (Id. at 4; D.I. 679 at 1) The court concludes, however, that further evidence is not necessary to resolve the issue.

n21 Union Carbide's brief is internally inconsistent on this point, initially asserting that interest should be compounded quarterly but later stating that it should be compounded annually. (D.I. 661 at 1-2, 4)

[*63]

The rate, if any, of prejudgment interest to be awarded is within the discretion of the court. See *Studiengesellschaft Kohle, m.b.H. v. Dart Industries, Inc.*, 862 F.2d 1564, 1580 (Fed. Cir. 1988). A patent holder need not prove that it borrowed at the prime rate in order to be entitled to prejudgment interest on that basis. See *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 939 F.2d 1540, 1545 (Fed. Cir. 1991). The determination of whether to award simple or compounded interest is within the discretion of the court. See *Rite-Hite Corp.*, 56 F.3d at 1555.

The court finds that the appropriate rate of interest to be awarded in the present case is the prime rate. Mindful of its discretion, the court finds that simple interest will adequately compensate Union Carbide in this case. Interest will be awarded for a period beginning on July 1, 1993 and ending on May 31, 2004. Based upon the jury award of \$ 112,198,893, the court finds that Union Carbide is entitled to prejudgment interest in the total amount of \$ 42,403,108.67. n22

n22 In calculating the interest, the court relied upon catalysts actually used internally and sold externally during each year beginning in July 1993. (D.I. 2204) The court then calculated simple interest for each year based upon the total accrued amount of catalyst used or sold through that year. (D.I. 689 ex. A) For the years 2003 and 2004 the court prorated the interest consistent with number of months for which interest was to be applied.

[*64]

VI. PERMANENT INJUNCTION

Union Carbide seeks a permanent injunction enjoining Shell from making, using, selling or offering for sale: (1) the Shell catalysts, S-880, S-882 and S-863,

for use in a process for the production of ethylene oxide or (2) any other Shell catalyst falling within the scope of claim 4 of the '243 patent. In a patent infringement suit, a district court may grant a preliminary injunction pending trial or a permanent injunction "after a full determination on the merits." *High Tech. Med. Instr., Inc. v. New Image Indus., Inc.*, 49 F.3d 1551, 1554 (Fed. Cir. 1995). Indeed, the Federal Circuit has indicated that once a finding of infringement has been made, an injunction should issue absent a sufficient reason for denying it. *Richardson v. Suzuki Motor Co., Ltd.*, 868 F.2d 1226, 1247 (Fed. Cir. 1989). Courts, therefore, are given wide latitude in framing injunctive relief. See *KSM Fastening Sys., Inc. v. H.A. Jones Co.*, 776 F.2d 1522, 1527 (Fed. Cir. 1985). Nonetheless, consistent with the equitable nature of a permanent injunction, the court "must consider all circumstances, including the adequacy of the [*65] legal remedy, irreparable injury, whether the public interest would be served, and the hardship on the parties and third parties". *E.I. du Pont de Nemours & Co. v. Phillips Petroleum Co.*, 659 F. Supp. 92, 94 (D. Del. 1987). Additionally, *Fed. R. Civ. P. 65(d)* requires an injunction to "set forth the reasons for its issuance, be specific in its terms, and shall describe in reasonable detail, and not by reference to the complaint or other document, the act or acts sought to be restrained; and is binding only upon the parties to the action." *Fed. R. Civ. P. 65(d)*.

In the present case, the court finds that Union Carbide will suffer irreparable harm without a permanent injunction to prevent Shell from practicing its patented catalytic process for the manufacture of EO. See *H.H. Robertson Co. v. United Steel Deck, Inc.*, 820 F.2d 384 (Fed. Cir. 1987). Further, the court finds that there are not countervailing equities in the present case to the patentee's right to exclude others from practicing the invention. Accordingly, the court finds that a permanent injunction is warranted. [*66]

The parties agree that the scope of the injunction should not include catalysts upon which damages were awarded by the jury. Therefore, the court will order a permanent injunction barring Shell from making, using or selling S-880, S-882 and S-863 catalysts which were not covered by the jury's damages award.

Shell seeks a stay of this injunction pending resolution of Shell's anticipated appeal to the Federal Circuit. (D.I. 681) Pursuant to *Fed. R. Civ. P. 62(c)*, it is within the discretion of the court to stay an injunction pending the outcome of an appeal of the judgment. A determination to stay a permanent injunction is guided by four factors: (1) likelihood of success on the merits of the appeal; (2) irreparable injury absent a stay; (3) substantial injury to the other party if the stay is granted; and (4) the public interest. *Hilton v. Braunskill*, 481 U.S.

770, 95 L. Ed. 2d 724, 107 S. Ct. 2113, (1987); *Standard Havens Products, Inc. v. Gencor Industries, Inc.*, 897 F.2d 511, 512 (Fed. Cir. 1990). The four factors often effectively merge as the likelihood of success is weighed with the equities affecting the parties and the [*67] public. *Standard Havens Products, Inc.*, 897 F.2d at 513.

With respect to the first factor, the parties have raised complex issues of law, issues which this court and the parties recognize would ultimately be resolved on appeal. Union Carbide can not fairly assert that a permanent injunction would not affect Shell's commercial practices as the record clearly demonstrates that the infringing catalysts are a substantial source of revenue. Further, the court is mindful of the fact that the legal holder of the patent is a technology holding company; there is nothing in the record to suggest that UCCPTC's interests would not be adequately protected through an appeal bond or similar assurance. Finally, the court finds that there are not unique public interests weighing in either party's favor in the present patent dispute. Consequently, the court finds that the equities in the present case substantially weigh in favor of maintaining the status quo. Therefore, the permanent injunction will be stayed pending the outcome of any appeals.

VII. CONCLUSION

For the reasons discussed above, the court will deny Shell's post-trial motions for judgment as a matter of law [*68] or in the alternative for a new trial. (D.I. 605, 607, 609, 611, 613, 615, 617, 645, 647, 649, 651, 653, 655, 657) The court will also deny Union Carbide's motion for judgment as a matter of law on its claim of willful infringement. (D.I. 662) The court has also found that Shell has failed to prove by clear and convincing evidence its equitable defenses of laches and estoppel. Therefore, the court will enter judgment in favor of Union Carbide for damages in the amount of \$ 111,212,665.02 and prejudgment interest in the amount of \$ 42,403,108.67. Finally, the court will grant Union Carbide's motion for permanent injunction (D.I. 665), but will also grant Shell's motion for a stay of the permanent injunction pending the outcome of any appeals. (D.I. 681) An order consistent with this opinion shall issue.

ORDER

At Wilmington, this 9th day of June, 2004, consistent with the memorandum opinion in the above captioned case issued this same day;

IT IS ORDERED that:

1. Defendants' motion to exclude certain testimony of Dr. Parvez H. Wadia is **denied**. (D.I. 704)

2. Defendants' motion for judgment as a matter of law on plaintiffs' claim of willfulness is **denied as moot** per [*69] the jury's verdict. (D.I. 615)

3. Defendants' motions for judgment as a matter of law or, in the alternative, for a new trial are **denied**. (D.I. 605; D.I. 607; D.I. 609; D.I. 611; D.I. 613; D.I. 617; D.I. 645-1; D.I. 645-2; D.I. 647-1; D.I. 647-2; D.I. 649; D.I. 651-1; D.I. 651-2; D.I. 653-1; D.I. 653-2; D.I. 655-1; D.I. 655-2; D.I. 657-1; D.I. 657-2)

4. Plaintiffs' motion for judgment as a matter of law is **denied**. (D.I. 662)

5. Plaintiffs' motion for prejudgment interest is **granted**. (D.I. 661)

6. Plaintiffs' motion for a permanent injunction is **granted**. (D.I. 665)

7. Defendants' motion for a stay of the permanent injunction is **granted**. (D.I. 681)

8. IT IS THEREFORE ADJUDGED AND DECREED that, within fifteen (15) days after the entry of this order until April 10, 2007, the expiration date of *United States Patent No. 4,916,243* ("the '243 patent"), defendants Shell Oil Company, Shell Chemical Company and CRI Catalyst, their officers, agents, servants, employees, and attorneys as well as all persons in active concern or participation therewith are hereby enjoined from: (1) making, using, selling, or offering to sell in the United States the S-880, S-882 [*70] and S-863 catalysts used in a process for making ethylene oxide found by the jury in this case to have infringed claim 4 of the '243 patent, except that the injunction against said catalysts shall not apply to the use of any charges of those catalysts that were included in the plaintiffs' evidence at trial to support an award of damages; and (2) making, using, selling or offering to sell in the United States any other Shell catalyst falling within the scope of the catalyst limitations of claim 4 of the '243 patent for use in an ethylene oxide production system in the United States.

9. IT IS FURTHER ADJUDGED AND DECREED that, pursuant to *Fed. R. Civ. P. 62*, this permanent injunction is hereby stayed during the pendency of any appeals of the judgment in this case. The stay shall be effective until the issuance of the Federal Circuit's mandate of a decision on the merits of any appeal of the judgment of the case.

10. The clerk of the court is directed to enter judgment in favor of plaintiffs and against defendants in the amount of \$ 153,615,773.69.

Sue L. Robinson

United States District Court

EXHIBIT C

LEXSEE 402 F3D 1371

RHODIA CHIMIE and RHODIA, INC., Plaintiffs-Appellants, v. PPG INDUSTRIES INC., Defendant-Appellee.

04-1246

UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

402 F.3d 1371; 2005 U.S. App. LEXIS 5869

April 11, 2005, Decided

PRIOR HISTORY: [*1] Appealed from: United States District Court for the District of Delaware. Judge Kent A. Jordan. *Rhodia Chimie v. PPG Indus.*, 303 F. Supp. 2d 502, 2004 U.S. Dist. LEXIS 941 (D. Del., 2004)

DISPOSITION: Affirmed in part, reversed in part and remanded.

LexisNexis(R) Headnotes

COUNSEL: Eric H. Weisblatt, Burns, Doane, Swecker & Mathis, L.L.P., of Alexandria, Virginia, argued for plaintiffs-appellants. With him on the brief were Monte M. Bond, Norman H. Stepno, Todd R. Walters, and Bruce J. Boggs, Jr. Of counsel on the brief were N. Richard Powers, James D. Heisman, and Rudolph E. Hutz, Connolly, Bove, Lodge & Hutz, L.L.P., of Wilmington, Delaware. Of counsel were Erin M. Dunston, Burns, Doane, Swecker & Mathis, L.L.P., and James D. Heisman, Connolly, Bove, Lodge & Hutz, L.L.P.

John M. Skenyon, Fish & Richardson P.C., of Boston, Massachusetts, argued for defendant-appellee. With him on the brief was Jolynn M. Lussier.

JUDGES: Before NEWMAN, CLEVINGER, and GAJARSA, Circuit Judges.

OPINIONBY: GAJARSA

OPINION: GAJARSA, Circuit Judge.

Rhodia Chimie and Rhodia, Inc. (collectively "Rhodia") appeal from a decision by the United States District Court for the District of Delaware granting

summary judgment on Rhodia's claims of patent infringement in favor of defendant PPG Industries, Inc ("PPG"). *Chimie v. PPG Indus.*, 303 F. Supp. 2d 502 (D. Del. 2004) ("Summary Judgment Opinion"). Rhodia also appeals the district court's decision to exclude as untimely certain evidence proffered by Rhodia. Because the district court properly construed the disputed claim terms and did not abuse its discretion in excluding Rhodia's proffered evidence, we affirm in part the court's decision. We conclude, however, that the evidence properly before the court created a genuine issue of material fact regarding one of PPG's accused products and therefore we reverse in part for further proceedings consistent with this opinion.

I. BACKGROUND

Rhodia is an international chemical company that is the assignee of United States Patent Number 6,013,234 ("the '234 patent"). The '234 patent discloses and claims certain essentially spheroidal precipitated silica particulates and their process of manufacture. Only one of the product claims of the '234 patent and none of its process claims were asserted in the instant litigation. Rhodia markets the silica particulate covered by the terms of the '234 patent under the trademark "Micropearl." Micropearl silica is used as a filler to reinforce elastomeric products such as automobile tires and as [*3] a carrier in the nutraceutical industry.

The initial application that led to the '234 patent was filed in April 1980. n1 Conventional elastomeric fillers in use at that time, such as carbon black, were inherently dusty and did not flow easily. The '234 patent was designed as an improvement to granulated silica and silica powders. The form of silica described in the '234 patent has an "essentially spheroidal" geometry of a certain mean particle size and morphology that

distinguishes it from the prior art. '234 patent, Abstract. Claim 1 of the '234 patent, the only claim at issue here, reads in its entirety:

Dry, dust-free and non-dusting, solid and homogenous atomized precipitated silica particulates essentially spheroidal in geometrical configuration, said particulates having a mean particle size in excess of 150 microns, a fill density in compacted state in excess of 0.200, a BET surface area ranging from 100 to 350 m²/g, and a CTAB surface area ranging from 100 to 350 m²/g.

'234 patent, col. 13, ll. 61-67 (emphases added). The underlined terms are disputed by the parties.

n1 The '234 patent, which issued January 11, 2000, was the culmination of eleven continuation applications filed between October 23, 1981 and April 28, 1994.

[*4]

In addition to the claim language identified above, the specification of the '234 patent contains ten examples of silica products and the results of several tests making comparisons among those products. The test results were designed to show ways that a person of ordinary skill could understand or comprehend the advantages of the claimed invention and differentiate it from the prior art. The cited tests considered both the flowability and the dusting properties of the different silica products. Flowability was identified as a "relative measurement" and defined as "the time required for the product to flow into appropriate receptable [sic] having a calibrated aperture under slight vibration." '234 patent, col. 4, ll. 29-32.

The tests conducted to assess the properties of the claimed invention included: (1) a pour test which constituted a side-by-side comparison of the flowability of the Micropearl silica versus the prior art; and (2) tests to measure the level of dust formed by the various silica particulates, including a test using the DIN 53 583 standard (the "DIN test"). The DIN test is a German standard developed to measure certain physical properties of carbon black by determining [*5] the fines (dust) and weight loss by abrasion according to a defined procedure.

In June 2001, Rhodia sued PPG for willful infringement of claim 1 of the '234 patent. Rhodia

identified three silica products made by PPG that it alleged infringed its patent rights. The three accused products were identified as Hi-Sil SC60M, SC72, and SC72C.

The district court held a Markman hearing regarding the construction of the terms of Claim 1. The primary disputed term at issue in this appeal is the limitation "dust-free and non-dusting." n2 PPG asserted that the term "dust-free and non-dusting" should be interpreted literally to mean "no dust cloud whatsoever." Conversely, Rhodia argued that a person of ordinary skill in the art would not ascribe such a meaning to the claim term, particularly in light of the results of the pour test showing that the invention produced some dust. Rhodia advocated construing "dust-free and non-dusting" to mean "very low dust."

n2 We also address the proper construction of the term "atomized precipitated silica particulates" in Section III. C *infra*. As explained below, the construction of this second disputed term was not dispositive to the district court's decision, but may be relevant on remand.

[*6]

The court construed the disputed term as follows:

"dust-free and non-dusting" means "a level of dust formation associated with the silica particulates of the '234 patent, as measured in percentage weight according to DIN 53 583, that has a fines content value less than or equal to 13 and weight loss by abrasion value less than or equal to 0.5."

Chimie v. PPG Indus., 2003 U.S. Dist. LEXIS 18695, Civ. Action No. 01-389, slip op. at 21-22 (D. Del. Oct. 9, 2003) ("Claim Construction Opinion"). The court clarified its reference to DIN 53 583 with a detailed explanatory footnote:

'DIN 53 583' is an industrial standard provided by the Deutsches Institut fur Normung e. V., a self-governing institution of trade and industry responsible for the preparation of National Standards in Germany, for measuring the fines content and weight loss by abrasion of palletized carbon black used as fillers

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in the rubber processing industry. The inventors of the '234 patented silica made specific reference to that standard as a means of measuring the dust qualities of their silica. I am referring specifically to DIN 53 583 dated November 1969.

2003 U.S. Dist. LEXIS 18695, at *14 n. 3.

The court's construction [*7] of "dust-free and non-dusting" was a reflection of its determination that the term was ambiguous because it could not be read literally to mean that the invention creates no dust at all. 2003 U.S. Dist. LEXIS 18695, at *14. The court was concerned, however, that Rhodia's proposed definition of the term to mean "very low dust" was a relative phrase which would not meet the statutory requirement that the claims "particularly point out and distinctly claim the subject matter which the applicant claims as his invention." Id. (citing 35 U.S.C. § 112 P2). In order to resolve the perceived ambiguity of the claim term in a manner that preserved the term's validity, the court adopted "a construction based upon the only meaningful guidance provided in the patent," namely the DIN test. Id.

Following the court's rejection of Rhodia's motion to reconsider the Claim Construction Opinion, the parties expressly agreed to close all discovery related to case dispositive motions on November 5, 2003, with the filing of all such motions to follow immediately thereafter. Trial was scheduled to begin on February 23, 2004.

In accordance with the pre-trial schedule, PPG filed motions for summary [*8] judgment on the issues of invalidity, unenforceability and non-infringement of the '234 patent. On December 1, 2003, in conjunction with its opposition to PPG's motions, Rhodia filed a request for a continuance to extend the time for discovery in order to complete DIN testing and produce evidence supporting its claim for infringement. Between December 22, 2003 and January 9, 2004, Rhodia served PPG with three expert reports providing evidence of infringement through DIN testing results.

Subsequently, the court issued an order excluding Rhodia's DIN testing evidence as untimely. On January 23, 2004, the court issued an opinion granting PPG's motion for summary judgment of non-infringement on the basis that Rhodia had not established that PPG's products included the "dust-free and non-dusting" limitation of claim 1. *Summary Judgment Opinion*, 303 F. Supp. 2d 502. In so holding, the court determined that PPG's products did not literally infringe the '234 patent and that prosecution history estoppel barred Rhodia from asserting that the accused products infringe under the

doctrine of equivalents. 303 F. Supp. 2d 502, slip op. at 7-9. Because it found dispositive the issue of whether PPG's products meet the "dust-free [*9] and non-dusting" limitation, the court did not reach the other question raised by PPG's motions, namely whether the accused products meet the "atomized precipitated silica particulates" limitation.

Rhodia appeals the district court's grant of summary judgment and exclusion of its evidence. This court has jurisdiction pursuant to 28 U.S.C. § 1295(a)(1).

II. DISCUSSION

A. Standard of Review

We review a district court's grant of summary judgment de novo, reapplying the same standard used by the district court. *Ethicon Endo-Surgery, Inc. v. U.S. Surgical Corp.*, 149 F.3d 1309, 1315 (Fed. Cir. 1998). Summary judgment is appropriate if, drawing all factual inferences in favor of the nonmoving party, there is no genuine issue as to any material fact and the moving party is entitled to judgment as a matter of law. *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 255, 91 L. Ed. 2d 202, 106 S. Ct. 2505 (1986).

Courts determine patent infringement by construing the patent's claims and then applying that construction to the accused process or product. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 976 (Fed. Cir. 1995) (en banc), [*10] aff'd, 517 U.S. 370, 134 L. Ed. 2d 577, 116 S. Ct. 1384 (1996). Claim construction is a question of law reviewed without deference on appeal. *Cybor Corp. v. FAS Techs., Inc.*, 138 F.3d 1448, 1454 (Fed. Cir. 1998) (en banc). In determining whether summary judgment resolving the issue of literal infringement is proper, the court considers whether a "reasonable jury could find that every limitation recited in the properly construed claim either is or is not found in the accused device." *Bai v. L&L Wings*, 160 F.3d 1350, 1353 (Fed. Cir. 1998). Application of prosecution history estoppel to limit the doctrine of equivalents presents a question of law that this court reviews without deference. *Glaxo Wellcome, Inc. v. Impax Labs., Inc.*, 356 F.3d 1348, 1351 (Fed. Cir. 2004).

Evidentiary rulings are procedural matters that do not raise issues unique to patent law, therefore this court applies the law of the appropriate regional circuit in reviewing such rulings. *ATD Corp. v. Lydall, Inc.*, 159 F.3d 534, 548 (Fed. Cir. 1998). According to the law of the Third Circuit, which controls here, exclusion of evidence by the district [*11] court is reviewed by an appellate court for abuse of discretion. *Glass v. Phila. Elec. Co.*, 34 F.3d 188, 191 (3d Cir. 1994).

B. Claim Construction of "dust-free and non-dusting"

Courts construe claim terms in order to assign a fixed, unambiguous, legally operative meaning to the claim. *Liquid Dynamics Corp. v. Vaughan Co., Inc.*, 355 F.3d 1361, 1367 (Fed. Cir. 2004). Claim construction begins with the intrinsic evidence of record, looking first to the claim language itself to define the scope of the patented invention. *Vitronics Corp. v. Conceptiontronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996). "When the claim language itself lacks sufficient clarity to ascertain the scope of the claims," we look to the written description for guidance. *Deering Precision Instruments, L.L.C. v. Vector Distrib. Sys., Inc.*, 347 F.3d 1314, 1324 (Fed. Cir. 2003). We consult the written description "to determine whether the inventor has used any terms in a manner inconsistent with their ordinary meaning. The specification acts as a dictionary when it expressly defines terms used in the claims or when it defines terms by implication. [*12] " *Vitronics*, 90 F.3d at 1582. Finally, we refer to the prosecution history, when it is of record, to discern the applicant's express acquiescence with or distinction of the prior art as further indication of the scope of the claims. *Liquid Dynamics*, 355 F.3d at 1368.

Here the district court determined that the disputed term "dust-free and non-dusting" could not be read literally to mean that the invention creates no silica dust at all. *Claim Construction Opinion*, 2003 U.S. Dist. LEXIS 18695, slip op. at 10. It reached this conclusion recognizing that the test results detailed in the written description indicate that the invention itself produces some dust, but less dust than the prior art. '234 patent, Figs. 3-6 & Tables I & II. Because a literal construction of the term "dust-free and non-dusting," which PPG advocates to mean "no dust cloud whatsoever," would not read on the preferred embodiment, we agree with the district court that a person of ordinary skill in the art would not interpret this term in that manner. As we have frequently stated, a construction that "would not read on the preferred embodiment ... would 'rarely if ever [be] correct and would require highly [*13] persuasive evidentiary support.'" *Interactive Gift Express, Inc. v. Compuserve Inc.*, 231 F.3d 859, 876 (Fed. Cir. 2000) (quoting *Vitronics*, 90 F.3d at 1583); *Hoechst Celanese Corp. v. BP Chems. Ltd.*, 78 F.3d 1575, 1578 (Fed. Cir. 1996); see also *Modine Mfg. Co. v. United States Int'l Trade Comm'n*, 75 F.3d 1545, 1550 (Fed. Cir. 1996) ("a claim interpretation that would exclude the inventor's device is rarely the correct interpretation"). The specification, prosecution history and prior art contain no "highly persuasive evidentiary support" that would require reaching such an unlikely construction. *Modine Mfg.*, 75 F.3d at 1550.

Relying on the use of the term in the written description, Rhodia proposes that the term "dust-free and

non-dusting" should be construed to mean that the level of dust "is very low when compared to other silica forms." As the district court recognized, this definition is "a relative phrase, including within its ambit a desirable characteristic of the invention," which can only be understood in comparison to the prior art. *Claim Construction Opinion*, 2003 U.S. Dist. LEXIS 18695, slip op. at 10. Accordingly, [*14] we look to the written description to determine the scope afforded to the comparative phrase very low levels of dust.

The written description includes ten examples of different forms of silica selected to illustrate the advantages of the invention. '234 patent, col. 3, l. 40 -- col. 8, l. 48. Varying combinations of the examples were subjected to testing designed to quantify certain physical properties in order to document and reveal the patentable characteristics of the claimed invention. The resultant physical properties of the ten examples are accumulated in Tables I and II of the '234 patent "such that the physiochemical properties of the various final products can be compared." '234 patent, col. 7, ll. 23-24. It is worth noting that, with the exception of particle size, all the physical properties for which numerical ranges are specifically provided in Claim 1, namely fill density, BET surface area and CTAB surface area, are outlined in Tables I and II. "Dust formation and abrasion as in DIN 53 583, in % by weight" appears in the last row of each of each table.

Although ten examples of silica products are referenced in the written description, the parties agree that only two [*15] of the examples constitute a product of the issued claims: Examples 5 and 10. Example 5 is twice referred to as the product of the invention: "As additional illustrations of the product according to the invention, Fig. 1 is an enlarged photograph of a pellet according to the invention (Example 5)," *Id.*, col. 8, ll. 50-51, and "the product according to the invention (Example 5)," *Id.*, col. 9, ll. 2-3. Example 10 is a refined version of Example 5. *Id.*, col. 8, l. 45. Thus, although ten examples are addressed in the description, the preferred embodiment of Example 5 is repeatedly described as the invention itself. See *id.*, col. 8, ll. 50-51 & col. 9, ll. 2-3.

The written description identifies two tests that were conducted to assess the tendency of the different examples to form dust. The first test was conducted on Examples 1, 2, and 4, whereas the second test was conducted on Examples 4, 5, 9 and 10. The first test used stable, fluidized beds of Examples 1, 2 and 4 and applied a vector gas to them to assess "the quality of the resulting product ... expressed in terms of the formation of dust therefrom and its resistance to attrition." *Id.*, col. 6, ll. 47-49. The [*16] description of this test concluded with the statement: "dust formation and abrasion were also

measured in accordance with the standard DIN 583 [sic]." *Id.*, col. 6, ll. 66-67.

Results according to the DIN 53 583 standard were provided for Examples 4, 5, 9 and 10. *Id.*, Tables I and II. Because the only measurement of the dust produced by Examples 5 and 10 was articulated in terms of the DIN 53 583 standard, the district court properly incorporated that articulation into its construction of the term "dust-free and non-dusting." The results of the DIN testing showed that Example 5 produced more dust than Example 10. Accordingly, the court defined the outer limit for the level of dust created by the invention by reference to the DIN test results for Example 5.

We agree with the district court that the reference to the DIN test results for Example 5, as provided in the written description, reconciles the ambiguous claim language with the inventor's disclosure. *Comark Communications, Inc. v. Harris Corp.*, 156 F.3d 1182, 1187 (Fed. Cir. 1998) (indicating that interpreting claim language in light of the specification is proper when a term is "so amorphous that one [*17] of skill in the art can only reconcile the claim language with the inventor's disclosure by recourse to the specification"). As such, the court's construction of the term "dust-free and non-dusting" does not contravene the basic teaching that limitations from the specification should not be imported to the claims. *Id.* at 1186-87; see also *E.I. Du Pont de Nemours & Co. v. Phillips Petroleum Co.*, 849 F.2d 1430, 1433 (Fed. Cir. 1988) (counseling that it is improper to read a limitation "into a claim from the specification wholly apart from any need to interpret what the patentee meant by particular words or phrases in the claim"). Furthermore, this construction is consistent with the proposition that "when the preferred embodiment is described in the specification as the invention itself, the claims are not necessarily entitled to a scope broader than that embodiment." *Modine Mfg.*, 75 F.3d at 1551.

Rhodia challenges the court's construction on the grounds that the DIN 53 583 standard is not the only means by which to assess the amount of dust produced by the invention in comparison to the prior art. It asserts that the pour test, which [*18] was applied to Example 5, could also be used to determine the level of dustiness identified in the claim. The written description provides the following summary of the pour test:

The test comprises placing one liter of the product to be studied in an Erlenmeyer flask having a neck 4.4 cm in diameter. The flask is rocked and the flowability of the product visually observed. The height from which the product is spilled is 63 cm. The experiment is shown in Fig. 3 at

the very instance that the product begins to flow/spill, and then, in the subsequent photographs, every two seconds thereafter.

It will be seen from the first photograph that the product according to the invention has a fluid appearance and was more freely flowing from the very outset. It can then clearly be seen that the product according to the invention not only flows better than a product in powder form (that prepared as in Example 2), but also flows better than a granulated product as prepared in Example 4. The granulated product is in the center of the photographs while the product according to the invention (Example 5) is at the right hand side thereof.

'234 patent, col. 8, l. 54 -- col. 9, l. [*19] 3. According to Rhodia, the results of the pour test, which appear in the patent only as a series of pictures, can serve as an alternative means of distinguishing the level of dust produced by the invention from the prior art and therefore it is inappropriate to limit the term "dust-free and non-dusting" to the DIN specifications. In support of this interpretation, Rhodia relies heavily on statements made during the prosecution of the patent showing that the pictures of the pour test were cited as evidence of the "non-dusting and free-flowing properties."

Rhodia's argument ignores the written description of the patent and the fundamental purpose of the claims, which is to define the scope of the patented invention. *Liquid Dynamics*, 355 F.3d at 1368. Although the pour test may also provide evidence of the dust produced by the various forms of silica, the results presented in the patent were only identified as evidence of the products' flowability. See '234 patent, col. 8, ll. 56-57. There is no language in either the claims or the written description that teaches application of the pour test to determine the level of dust production claimed by the invention and [*20] Rhodia's statements made during the prosecution of the patent cannot serve to fill that gap. "Although the prosecution history can and should be used to understand the language used in the claims, it ... cannot 'enlarge, diminish, or vary' the limitations in the claims." *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 980 (Fed. Cir. 1995). Although the pour test and the stabilized fluid bed test may provide alternative means for assessing dust production, it remains that the only articulation of the dustiness of the claimed invention is made with reference to the DIN 53 583 standard.

Rhodia chose to define the term "dust-free and non-dusting" solely by reference to characteristics of the prior art and the only comparison of those characteristics was explained according to the DIN 53 583 standard. It was not improper for the district court to limit the scope of this relative term to the only disclosure on the subject made in the patent. We affirm the claim construction of the district court.

C. Summary Judgment of Non-infringement

Applying its construction of the term "dust-free and non-dusting" to the three accused products, the district court determined that [*21] none of the three met the limitation as defined. Accordingly, it found that the accused products did not literally infringe the '234 patent. *Summary Judgment Opinion*, 303 F. Supp. 2d 502, slip op. at 6-7. The court also found that Rhodia was not entitled to any scope of equivalents with respect to the limitation "dust-free and non-dusting" because the limitation was added during prosecution in order to avoid the prior art. 303 F. Supp. 2d 502, slip op. at 8-9. Rhodia challenges the court's infringement findings, both as to literal infringement and infringement under the doctrine of equivalents.

Rhodia attacks the court's finding of no literal infringement on evidentiary grounds. First, it argues that it was improperly denied the opportunity to submit evidence showing the results of its testing under the DIN 53 583 standard. Alternatively, Rhodia asserts that even without the excluded DIN test results, the evidence submitted raised a genuine issue of material fact such that the district court erred in entering summary judgment of non-infringement.

Rhodia's assertion that the district court abused its discretion in excluding its DIN testing evidence is without merit. Rhodia claims that because the machinery for conducting [*22] DIN testing was not readily available, it was not able to produce the necessary results and related expert report in the four weeks between the time the court issued its Claim Construction Opinion and the close of discovery. Accordingly, it believes that it was entitled to an extension of discovery in order to respond to the court's construction of "dust-free and non-dusting" by reference to the DIN 53 583 standard.

Rhodia's argument was presented to and rejected by the district court, which found that it was unreasonable for Rhodia to delay investigation into DIN testing until after the issuance of the Claim Construction Opinion. See *Chimie v. PPG Indus. Inc.*, 303 F. Supp. 2d 502, slip op. at 1 (D. Del. Jan. 23, 2004) ("Order Denying Reconsideration of Evidentiary Decision"). The court found that Rhodia was on notice at least as early as the summer of 2003 that the court considered the DIN 53 583 standard relevant to the construction of the disputed

term. 303 F. Supp. 2d 502, slip op. at 2. In support of that finding, the court noted that it inquired into the English translation of the DIN 53 583 standard in July 2003 and then, in August 2003, it explicitly invited the parties [*23] to provide input on the construction of the term "dust-free and non-dusting" in light of that standard. *Id.* Because Rhodia submitted its DIN testing evidence seven weeks after the close of discovery and the passing of the deadline for filing case dispositive motions and six weeks prior to trial, the Court held that PPG would be substantially and unfairly prejudiced if such evidence was admitted. See *Rhodia Chimie v. PPG Indus., Inc.*, 2004 U.S. Dist. LEXIS 27822, Civ. Action No. 01-389, slip op. at 2 (D. Del. Jan. 16, 2004) ("Order Excluding Evidence").

Rhodia presents no authority in support of its assertion that the district court's decision to exclude its evidence as untimely was an abuse of discretion. When a party fails to obey an order regarding discovery, *Federal Rule of Civil Procedure* 37 provides district courts with broad discretion to "make such orders in regard to the failure as are just," which includes "prohibiting the party from introducing designated matters in evidence." *Fed. R. Civ. Proc.* 37(b)(2). While recognizing the severity of a decision to exclude critical evidence for failure to comply with a pretrial [*24] order, the Third Circuit will not disturb the trial court's decision "absent a clear abuse of discretion." *Semper v. Santos*, 845 F.2d 1233, 1237 (3d Cir. 1988). The Third Circuit typically considers four factors in evaluating whether the district court properly exercised its discretion. *In re TMI Litig.*, 193 F.3d 613, 721 (3d Cir. 1999). Those factors are: (1) the prejudice or surprise in fact of the party against whom the excluded evidence would have been submitted; (2) the ability of that party to cure the prejudice, (3) the extent to which waiver of the discovery deadline would disrupt the orderly and efficient trial of the case or of other cases in the court, and (4) bad faith or willfulness in failing to comply with the district court's order. See *id.* (citing *Meyers v. Pennypack Woods Home Ownership Assoc.*, 559 F.2d 894, 904-05 (3d Cir. 1977)).

None of the cited factors counsel in favor of finding that the district court abused its discretion. PPG filed timely case dispositive motions according to a schedule specifically agreed to by Rhodia after the issuance of the Claim Construction Opinion. The admission of Rhodia's untimely [*25] evidence would have undermined, if not negated PPG's motions for summary judgment and disrupted the scheduled trial. Because Rhodia did not submit its request for a continuation of discovery until well after the deadline had passed and its response to PPG's motions was due, PPG had no opportunity to correct the prejudice created by Rhodia's failure to comply with the district court's order. Rhodia offers no

explanation as to why it postponed engaging in DIN testing until the eve of the close of discovery and why it failed to bring its problems in conducting such testing to the attention of the court in a timely manner. Under the circumstances, we cannot say that the district court abused its discretion in excluding Rhodia's untimely evidence.

Rhodia also argues that, even without considering its untimely DIN testing evidence, the district court erred in entering summary judgment finding no literal infringement. It rests this argument on evidence provided by PPG showing DIN 53 583 results for SC60M within the range established by the court's claim construction. PPG argues that this evidence was irrelevant because the results were produced prior to the issuance of the '234 patent and [*26] Rhodia produced no evidence linking the sample tested to PPG's post-issuance commercial practices. In support of its theory requiring the establishment of a linkage, PPG relies on *Chiuminatta Concrete Concepts, Inc. v. Cardinal Industries, Inc.*, 145 F.3d 1303 (Fed. Cir. 1998). In *Chiuminatta*, we affirmed the district court's conclusion that a study performed after a patent's filing date was not relevant to determining whether the patent was obvious. *Id.* at 1313. We held that a post-filing date report was insufficient to raise a genuine issue of material fact regarding the state of the prior art unless evidence was produced that demonstrated the relationship of the report to the prior art. *Id.* Relying on that holding, PPG argues that Rhodia's production of pre-issuance evidence without more was insufficient to raise a genuine issue of material fact as to whether PPG's post-issuance products infringed.

PPG's reliance on *Chiuminatta* is misplaced. A determination of obviousness, as was at issue in *Chiuminatta*, turns on the scope and content of the art prior to the filing date of the patent application. *SIBIA Neurosciences, Inc. v. Cadus Pharm. Corp.*, 225 F.3d 1349, 1355-56 (Fed. Cir. 2000). [*27] Thus, as a prima facie matter, a report drafted after a patent application was filed would not inform the necessary inquiry into the scope and content of the prior art. In contrast, although a patent cannot be infringed by acts done before its issuance, evidence regarding pre-issuance activities may be relevant to establishing that post-issuance products constitute infringement. See *Hoover Group, Inc. v. Custom Metalcraft, Inc.*, 66 F.3d 299, 303 (Fed. Cir. 1995) (holding that pre-issuance engineering drawings and templates used to build accused products sold after the issuance of the patent could be relied on to show infringing characteristics). PPG's challenge to the link between PPG's accused product and the silica product tested in the report relied upon by Rhodia does not show that the report is irrelevant, but rather raises questions of

fact, the resolution of which will determine the weight to be afforded the evidence.

Although the existence of a pre-issuance report indicating that SC60M produced DIN 53 583 results in the range defined by the court's claim construction does not establish infringement, it does create a genuine issue of material fact as to whether [*28] the post-issuance form of SC60M infringes. Accordingly, the trial court erred as a matter of law in entering summary judgment of non-infringement for PPG's SC60M and we reverse for further proceedings limited to that product. Rhodia has identified no evidence establishing a genuine issue of material fact in regards to the other two accused products and therefore there is no reason to reverse the court's decision for SC72 or SC72C.

Rhodia also argues that it is entitled to show that PPG's products infringe under the doctrine of equivalents. It asserts this argument despite its acknowledgement that the limitation "dust-free and non-dusting" was added during prosecution to distinguish the claimed invention from the prior art. Rhodia claims that this amendment does not bar it from asserting equivalents under the doctrine of *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., Ltd.*, 535 U.S. 722, 733, 152 L. Ed. 2d 944, 122 S. Ct. 1831 (2002). Under *Festo*, a narrowing amendment made to satisfy a requirement of the *Patent Act* may give rise to an estoppel. *Id.* at 736. Such a narrowing amendment creates a presumption that the patentee surrendered the territory between [*29] the original claims and the amended claims. *Id.* at 741. The patentee may rebut that presumption by showing that the alleged equivalent was unforeseeable at the time the amendment was made, that the alleged equivalent was tangential to the purpose of the amendment, or that there was some other reason suggesting that the patentee could not reasonably be expected to have described the insubstantial substitute in question. *Id.* at 740-41. Rhodia argues that its amendment of Claim 1 to include the limitation "dust-free and non-dusting" does not estop it from asserting infringement under the doctrine of equivalents because the equivalent in question was tangential to the purpose of the amendment.

This court has held that the primary consideration in determining when an amendment bears only a tangential relation to the equivalent in question is "whether the reason for the narrowing amendment was peripheral, or not directly relevant, to the alleged equivalent." *Insituform Techs., Inc. v. Cat Contr., Inc.*, 385 F.3d 1360, 1370 (Fed. Cir. 2004) (citing *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., Ltd.*, 344 F.3d 1359, 1365 (Fed. Cir. 2003) [*30] (en banc)). Here, Rhodia argues that the prosecution history shows that the limitation "dust-free and non-dusting" was added to Claim 1 of the '234 patent to distinguish the invention of

precipitated silica particulates from the prior art of "powdered or granulated [or otherwise shaped] silicas." According to Rhodia, because the accused products are "spray-dried silica microspheres" and not "powdered or granulated silicas" they are not within the distinguished prior art and therefore the narrowing amendment is not directly relevant to the accused equivalents.

Rhodia misunderstands the scope of the inquiry into the relationship between the narrowing amendment and the accused equivalent. As we have stated, "an amendment made to avoid prior art that contains the equivalent in question is not tangential," *Festo*, 344 F.3d at 1369. It does not follow, however, that equivalents not within the prior art must be tangential to the amendment. Here, Rhodia amended its claim to incorporate numerous limitations identifying the specific characteristics that distinguished its invention from the prior art, including the trait that it was "dust-free and non-dusting." Rhodia's articulation [*31] of these characteristics was not limited to the form of the silica produced and therefore, Rhodia presumptively surrendered all forms of silica with dust levels too great to be considered "dust-free and non-dusting." As a claimed improvement over the prior art, the relative dustiness of Rhodia's invention was at issue during prosecution and thus the reason for the narrowing amendment cannot be said to be tangential to an equivalent that has that characteristic. *Talbert Fuel Sys. Patents Co. v. Unocal Corp.*, 347 F.3d 1355, 1360 (Fed. Cir. 2003) (holding that a narrowing amendment to address issues raised during prosecution was the "direct, not tangential, reason" for the narrowing amendment). Accordingly, we hold that Rhodia has not rebutted the presumption that it surrendered the range between its original claim and its amended claim and is therefore estopped from asserting infringement under the doctrine of equivalents.

C. Additional Issues

Although the district court's final judgment of non-infringement was based solely on the absence of evidence that PPG's products contain the limitation "dust-free and non-dusting," PPG had presented an alternative argument for [*32] summary judgment on the ground that its accused products do not include the limitation "atomized precipitated silica particulates." Despite disposing of the case on the "dust-free and non-dusting" limitation, the court expressly included its construction of "atomized precipitated silica particulates" into its Summary Judgment Opinion. Accordingly, the parties fully briefed the dispute regarding the construction of "atomized precipitated silica particulates" before this court. Furthermore, as discussed above, a limited remand of this case is necessary and the construction of this second term may be determinative in the future proceedings. Under these circumstances, we

conclude that judicial economy would best be served by our reviewing this second claim construction issue. *Microsoft Corp. v. Multi-tech Sys., Inc.*, 357 F.3d 1340, 1351 n. 6 (Fed. Cir. 2004) (reviewing the construction of all disputed claim terms, not just the ones necessary to resolve the appeal).

The district court interpreted the term "atomized precipitated silica particulates" to mean "that a pulverized slurry of precipitated silica is spray dried using a liquid pressure nozzle as an atomizer [*33] to form the claimed silica particulates." *Claim Construction Opinion*, 2003 U.S. Dist. LEXIS 18695, slip op. at 14-15. The court reached this construction by reference to the prosecution history, where Rhodia distinguished the prior art by emphasizing that its claimed silica particulates could be obtained only by applying liquid pressure nozzle sprayers to a pulverized slurry. 2003 U.S. Dist. LEXIS 18695, slip op. at 15. Rhodia argues that its statements regarding the use of liquid pressure nozzle sprayers and a pulverized slurry were directed at its process claims, which appear at claims 16-28 of the '234 patent, and not its product claims. Thus, Rhodia asserts, it was improper for the district court to rely on the prosecution history to interpret product Claim 1 in light of argument directed at the patent's process claims.

Rhodia's argument does not comport with well-established principles of claim construction. The purpose of consulting the prosecution history in construing a claim is to "exclude any interpretation that was disclaimed during prosecution." *ZMI Corp. v. Cardiac Resuscitator Corp.*, 844 F.2d 1576, 1580 (Fed. Cir. 1988). Accordingly, "where the patentee has unequivocally disavowed a certain meaning to obtain [*34] his patent, the doctrine of prosecution disclaimer attaches and narrows the ordinary meaning of the claim congruent with the scope of the surrender." *Omega Eng'g, Inc. v. Raytek Corp.*, 334 F.3d 1314, 1324 (Fed. Cir. 2003). Such a use of the prosecution history ensures that claims are not construed one way in order to obtain their allowance and in a different way against accused infringers. *Southwall Tech., Inc. v. Cardinal IG Co.*, 54 F.3d 1570, 1576 (Fed. Cir. 1995).

Over a series of responses to office actions, Rhodia amended Claim 1 to include the term "atomized precipitated silica particulates." The amendments were made, in part, to traverse rejections based on *U.S. Patent No. 3,383,172*, which was issued to Biegler et al., and *U.S. Patent No. 4,094,771*, which was issued to Brandt et al. The Biegler art disclosed a "method for preparing silica in the form of hollow spheres," *U.S. Patent No. 3,383,172*, Claim 1, whereas the Brandt art disclosed a "process for the production of a sprayable, highly concentrated aqueous suspension of a precipitated silicic acid," *U.S. Patent No. 4,094,771*, Claim 1.

Both the product and the process claims of the '234 [*35] patent were initially rejected as unpatentable in light of the Biegler and Brandt prior art. Rhodia distinguished the Biegler invention on the grounds that it disclosed a method for preparing silica in the form of hollow spheres and was directed at pyrogenic silica, unlike Rhodia's claimed invention of "precipitated silica." Furthermore, Rhodia noted that Biegler did not require a pulverization step and "no slurry which has not been pulverized per applicants' invention would be capable of ultimately providing a homogeneous and solid particulate product, much less those precipitated silica beads having those particular physical and chemical properties now set forth in all of applicant's newly presented claims."

Rhodia distinguished the Brandt invention on the grounds that "the spraying or atomization of the suspension obtained by the process of Brandt et al. does not necessarily lead to the claimed subject matter of the present invention ... the silica particulates are much smaller than the claimed atomized precipitated silica particulates of the present application." Furthermore, Rhodia argued that Brandt does not specify the type of nozzle or spray drying technique used in [*36] its process, whereas to obtain Rhodia's "claimed silica particulates, liquid pressure nozzle sprayers must be used."

In light of the prosecution history, it is evident that Rhodia disclaimed products created using non-pulverized slurries and atomization techniques other than liquid pressure nozzle sprayers. There is no indication that Rhodia attempted to limit these disclaimers to its process

claims. Rhodia was required to distinguish both its product and process claims from the inventions of Biegler and Brandt and it did so by focusing on the necessity of using liquid pressure nozzle sprayers and pulverized slurries to obtain its claimed product. Accordingly, we see no error in the district court's construction of the term "atomized precipitated silica particulates" to mean that "a pulverized slurry of precipitated silica is spray dried using a liquid pressure nozzle as an atomizer to form the claimed silica particulates." We affirm that construction.

III. CONCLUSION

For the foregoing reasons, we affirm the district court's construction of the disputed claim terms "dust-free and non-dusting" and "atomized precipitated silica particulates." We also affirm the district court's exclusion [*37] of Rhodia's evidence as untimely, its entry of summary judgment of no literal infringement for PPG products SC72 and SC72C, and its finding of no infringement by equivalence because of prosecution history estoppel for all three products. Because the district court erred in holding that there was no genuine issue of material fact regarding the literal infringement of PPG's product SC60M, we vacate the district court's grant of summary judgment as to SC60M and remand for further proceedings consistent with this opinion.

IV. COSTS

No costs.

AFFIRMED-IN-PART, REVERSED-IN-PART and REMANDED